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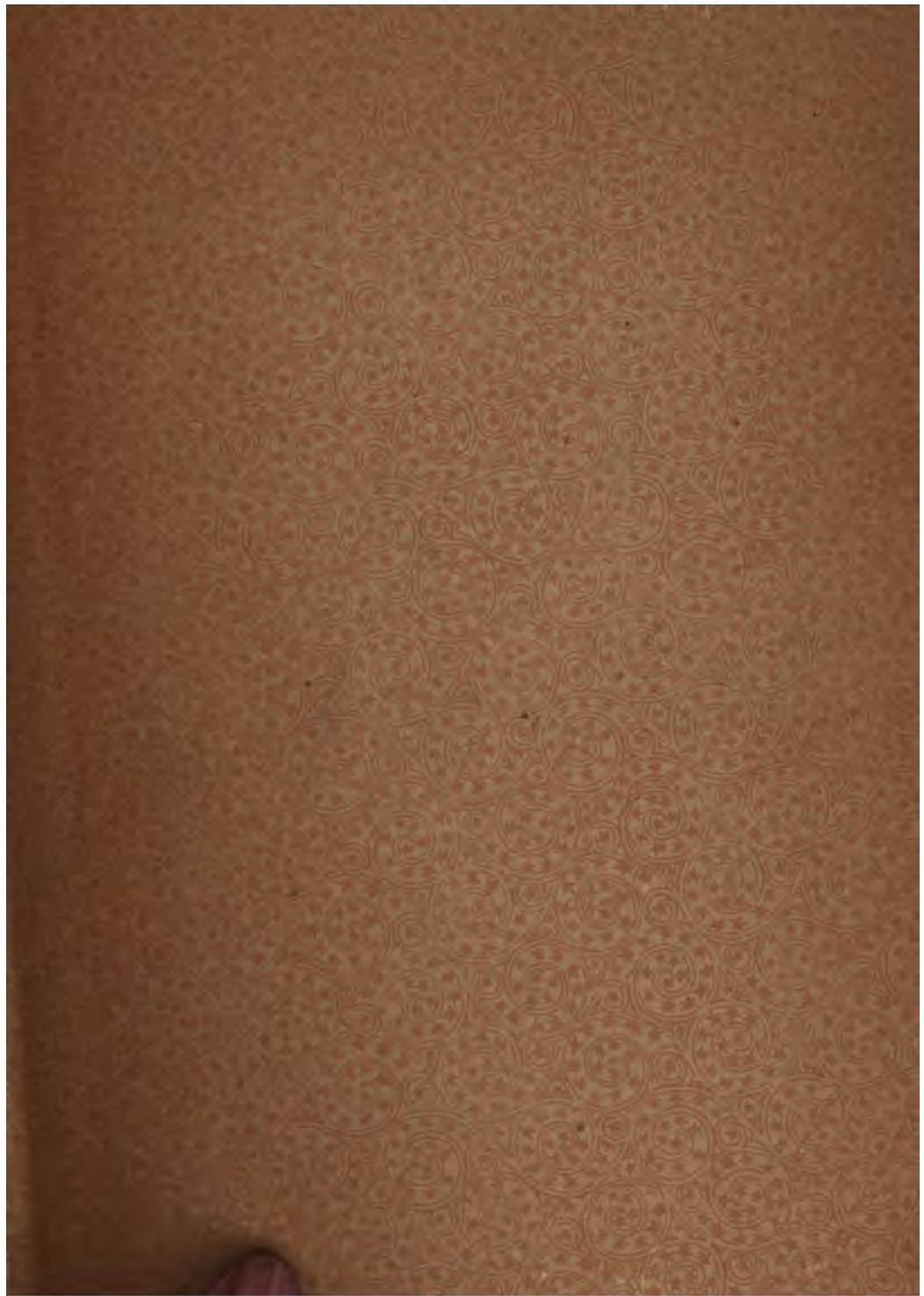
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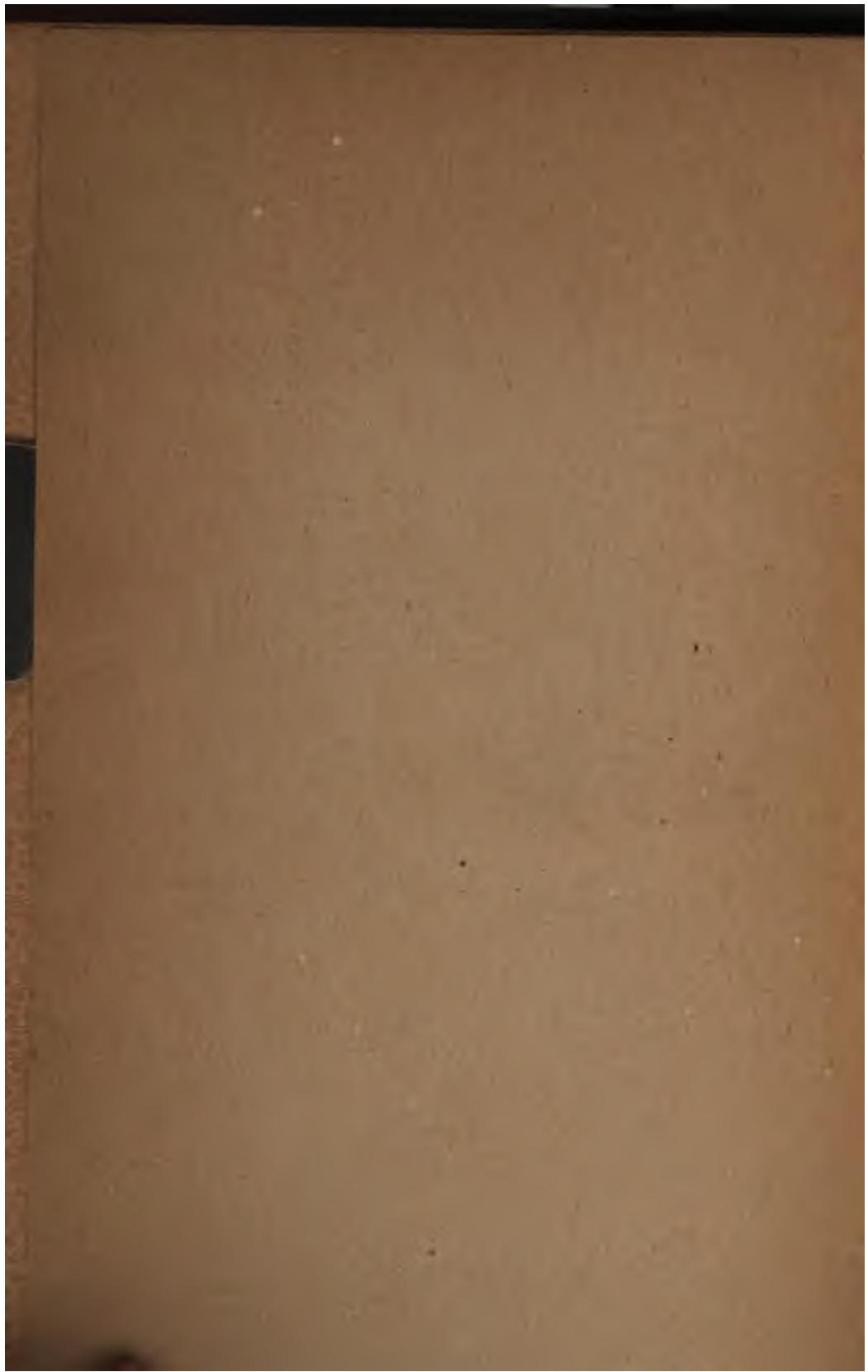


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DISEASES  
OF THE  
URINARY ORGANS  
INCLUDING  
DIABETES MELLITUS AND INSIPIDUS

BY  
CLIFFORD MITCHELL, A. B., M. D.  
PROFESSOR OF RENAL DISEASES IN THE CHICAGO HOMOEOPATHIC MEDICAL COLLEGE, UROLOGIST TO THE CHICAGO LABORATORY FOR CLINICAL DIAGNOSIS.

ILLUSTRATED.

LAWRENCE

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## DEDICATION.

TO THE GENERAL PRACTITIONER WHO  
IN THESE DAYS HAS NEED TO BE A  
“SPECIALIST IN EVERYTHING” THIS  
BOOK IS RESPECTFULLY DEDICATED.

29388



## P R E F A C E.

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It will be seen from the dedication that this book has been written for the purpose of giving special information in regard to diseases of the urinary tract to the general practitioner, who may any moment have need of knowledge so scattered about through literature as to be practically inaccessible to him. Effort has been made to give special prominence to the diagnosis and treatment of diseases of the kidneys, ureters, bladder, prostate and urethra, together with diabetes mellitus and insipidus. Inasmuch as modern surgery is playing an important part in the treatment of many urinary diseases, the writer has devoted considerable space to a consideration of the surgical treatment of such maladies.

It is believed that death may be prevented and suffering alleviated by an expert surgeon in a number of urinary diseases heretofore deemed solely within the province of internal medicine. While it may not be possible for the general practitioner to perform certain difficult surgical operations, he should at least become aware that his patient may possibly be saved by surgical means.

In the matter of general treatment much attention has been given by the writer to minute particulars of diet, climate and hygiene, upon which success in the management of a case so much depends.

In outlining a course of medical treatment effort has been made to be as broad as possible and to include almost everything recommended by earnest and reliable workers in the field of internal medicine. The writer has endeavored to specify as clearly as possible what remedies he himself has used and with what success.

Inasmuch as intelligent treatment of diseases of this nature requires a special knowledge of pathology, considerable attention has been given to this branch of the subject. The pathological classification adopted is that advised by Riesman in the *American Text-Book of Pathology*.

The writer must acknowledge his obligation to Dr. Charles Adams, of Chicago, for much valuable information in regard to modern surgery in its application to diseases of the urinary organs.

It is hoped that by means of this volume the treatment of urinary diseases—so obscure and so difficult to manage—may be made a little easier for the general practitioner.

*70 State St., Chicago, Sept. 1, 1903.*

## TABLE OF CONTENTS.

	Page.
<b>CHAPTER I. ANATOMY, PHYSIOLOGY, AND PATHOLOGICAL CLASSIFICATION, . . . . .</b>	<b>17</b>
<b>CHAPTER II. PHYSICAL EXAMINATION OF THE KIDNEYS, . . . . .</b>	<b>40</b>
<b>CHAPTER III. GENERAL CLINICAL FEATURES OF RENAL DISEASE, . . . . .</b>	<b>47</b>
<b>CHAPTER IV. ANOMALIES OF THE KIDNEYS: <i>Misplacements, movable kidney, floating kidney, horse-shoe kidney, lobulated kidney, anomalies of size, solitary kidney, unsymmetrical kidney, absence of the kidneys, . . . . .</i></b>	<b>53</b>
<b>CHAPTER V. THE UREMIC PHENOMENA OF RENAL DISEASE: <i>Acute Uremia. Chronic Uremia: Etiology, pathology, diagnosis, treatment. The methylene blue test, phloridzin diabetes, cryoscopy, . . . . .</i></b>	<b>71</b>
<b>CHAPTER VI. DISTURBANCES OF THE CIRCULATION OF THE KIDNEYS: <i>Thrombosis, embolism, aneurism, anemia; hyperemia, active and passive, . . . . .</i></b>	<b>89</b>
<b>CHAPTER VII. INFLAMMATIONS OF THE KIDNEY: <i>Classification. ACUTE NEPHRITIS: Parenchymatous, diffuse: post-scarlatinal, in measles, chicken-pox, malaria, whooping-cough, infectious sore throat, acute arthritis, diphtheria, pneumonia, typhoid fever, yellow fever, cholera, the plague, gastro-enteritis, from exposure, alcoholic, interstitial; the acute nephritis of pregnancy, . . . . .</i></b>	<b>112</b>
<b>CHAPTER VIII. CHRONIC NON-INDURATIVE NEPHRITIS: <i>Chronic diffuse nephritis without induration (chronic Bright's disease with dropsy) formerly called chronic parenchymatous nephritis. Chronic hemorrhagic nephritis without edema, . . . . .</i></b>	<b>161</b>
<b>CHAPTER IX. CHRONIC INDURATIVE NEPHRITIS: <i>Chronic diffuse nephritis with induration, including secondary interstitial nephritis (atrophy of the kidney), primary interstitial nephritis (contracting kidney), and arterio-sclerotic nephritis, . . . . .</i></b>	<b>204</b>
<b>CHAPTER X. DEGENERATIONS AND INFILTRATIONS OF THE KIDNEY. TRAUMA. FISTULA. Amyloid kidney. Calcareous and other infiltrations, pigmentations, hyaline degeneration, cloudy swelling, fatty change, chronic degeneration, syphilis of the kidney. Leprosy, glanders, actinomycosis, and leukemia. Injuries to the kidney. Fistula of the kidney, . . . . .</b>	<b>252</b>

	Page.
<b>CHAPTER XI. SUPPURATIVE NEPHRITIS and PARANEPHRITIS (PARA- NEPHRIC ABSCESS), . . . . .</b>	<b>266</b>
<b>CHAPTER XII. CYSTS AND TUMORS OF THE KIDNEY: Cystic kidney, hydatids, dermoid cysts, benign and malignant tumors, hyper- nephroma, . . . . .</b>	<b>280</b>
<b>CHAPTER XIII. TUBERCULOSIS OF THE KIDNEY, . . . . .</b>	<b>305</b>
<b>CHAPTER XIV. DISEASES OF THE PELVIS OF THE KIDNEY AND OF THE URETERS: Malformation, dilatation (<i>Hydronephrosis, Py- nephrosis</i>), hyperemia, hemorrhage, edema, inflammation (<i>Pyelitis</i>), tuberculosis, tumors, cysts, parasites, stone (<i>Calculus</i>). Ureteritis, .</b>	<b>321</b>
<b>CHAPTER XV. VARIOUS ABNORMAL STATES OF THE URINE: Lithuria or uricaciduria, oxaluria, phosphaturia, cystinuria, alkapturia, chyluria, hematuria, hemoglobinuria, . . . . .</b>	<b>380</b>
<b>CHAPTER XVI. DISEASES OF THE BLADDER: Malformations, mal- positions, dilatation, hypertrophy, atrophy, paralysis, irritability, circulatory disturbances, amyloid degeneration, inflammation (<i>Cystitis</i>), tuberculosis, syphilis, tumors, cysts, parasites, stone (<i>Vesical Calculus</i>), wounds, rupture, . . . . .</b>	<b>404</b>
<b>CHAPTER XVII. DISEASES OF THE PROSTATE: Malformations, atrophy, hypertrophy, congestion, inflammation, tuberculosis, tumors, cysts, and calculi, . . . . .</b>	<b>482</b>
<b>CHAPTER XVIII. DISEASES OF THE URETHRA: Malformations, wounds and rupture, hemorrhage, stricture, tuberculosis, syphilis, tumors, calculi and foreign bodies, inflammation (<i>Posterior Urethritis, Urethritis</i>). Urinary Fever, . . . . .</b>	<b>511</b>
<b>CHAPTER XIX. ENURESIS, . . . . .</b>	<b>523</b>
<b>CHAPTER XX. DIABETES MELLITUS AND INSIPIDUS, . . . . .</b>	<b>530</b>
<b>CHAPTER XXI. CLINICAL MEMORANDA: The mortality in 500 of the writer's cases of albuminuria. Diagnostic summary of thirty-three urinary diseases (useful for medical students studying for examina- tions). Pain as a clinical symptom of urinary diseases: thirty-five hints derived from observation of many cases. Uremia in its clinical bearing. The uremia of elderly men. Sequences and complications of urinary diseases. Examination of the urine as an aid to prognosis. Synopsis of modern renal pathology. Clinical notes, .</b>	<b>611</b>

## CHAPTER I.

### ANATOMY AND PHYSIOLOGY OF THE KIDNEYS. PATHOLOGICAL CLASSIFICATION.

The kidneys are two in number, and are glandular organs intended for the excretion of urine. From the arrangement of the tubules the kidney is classified among the *compound tubular glands*.

**Development.**—The kidney is developed from the so-called *mesonephros*, an outgrowth from the lower end of the Wolfian duct of the embryo.

**Location.**—At the upper and back part of the abdominal cavity, on either side of the spinal column, behind the peritoneum. The upper border corresponds with the space between the eleventh and twelfth ribs, the lower border with the middle of the third lumbar vertebra. They rest against the crura of the diaphragm and the anterior lamella of the posterior aponeurosis of the transversalis muscle, and to a slight extent on the psoas muscle.

The kidneys are almost completely enclosed by the ribs, and project only slightly beyond the twelfth rib. They lie in beds of fat and connective tissue.

The right kidney is usually a little lower than the left, owing to the liver above it crowding it down.

Fig. 1 shows the location of the kidneys with reference to the viscera, vertebrae and ribs.

**Topography.**—Anteriorly:—A horizontal line passing through the umbilicus lies just below the lower borders of both kidneys. A vertical line drawn perpendicularly from the middle of Poupart's ligament upward to the costal arch passes directly over the kidney a little external to its median line.

18 ANATOMY AND PHYSIOLOGY OF THE KIDNEYS.

Posteriorly :—A line parallel with the spinal column and one inch from it, extending from the lower edge of the tip of the spinous process of the eleventh dorsal vertebra to the

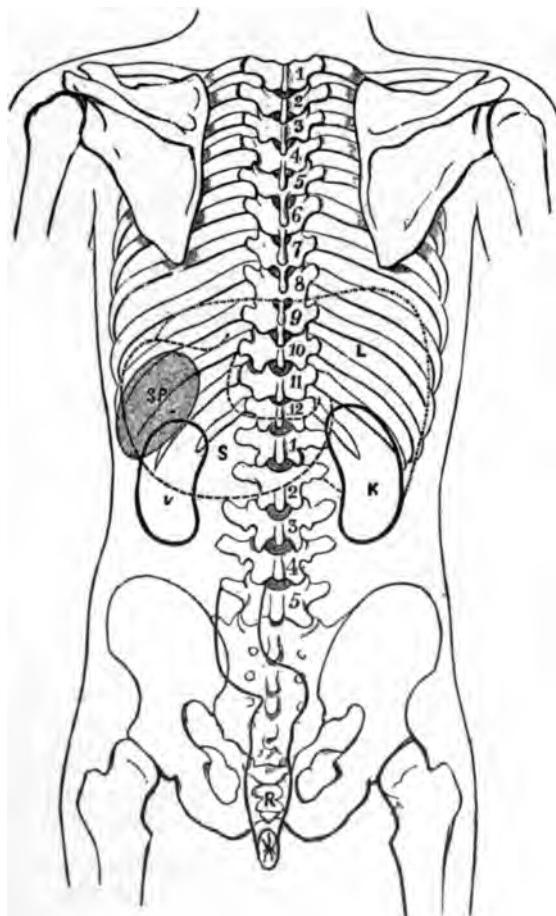


FIG. 1.—Diagram showing relation of the viscera to the parietes (posterior view). S, stomach; L, liver; K, kidney; SP, spleen; R, rectum.—(TREVES.)

lower edge of the spinous process of the third lumbar vertebra, would fall just inside the inner border of the kidney. If two lines be drawn from the ends of the line above described

horizontally outward for two and three-fourths inches, and the outer ends of these two lines joined by a perpendicular line, the whole kidney will normally lie within the four lines so drawn.

**Position of Surfaces.**—The anterior surfaces look obliquely outward and forward from either side of the bodies of the vertebræ. The posterior surfaces, which are rather more flattened than the anterior, look obliquely backward and inward toward the spines of the vertebræ. The upper end of the



FIG. 2.—Showing the normal surface relations of the kidneys anteriorly, and the method of determining these relations.—(BUTLER.)

kidney is nearer the spinal column, and is slightly more posterior in position than the lower end. The inner border of the kidney at its upper part is about an inch from the middle line of the body, while the outer border at its lower part is three and three-fourths inches from the middle line. The outer or convex border of the kidney looks obliquely upward, while the concave or inner border looks obliquely downward and forward.

**Relations of the Left Kidney.**—Anteriorly the left kidney has the stomach in front of its upper third, the splenic artery and pancreas in front of its middle third, and the descending colon in front of its lower third. Posteriorly its relations are the same as those of the right kidney. Externally the left kidney lies against the spleen for the upper two-thirds or three-quarters of its extent.

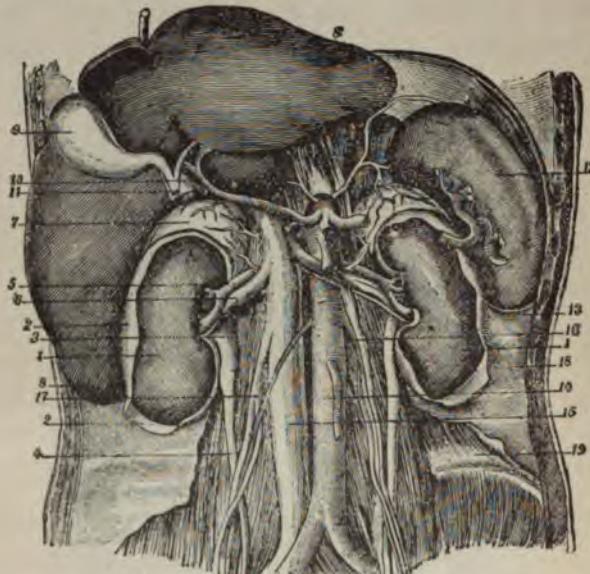


FIG. 3.—Relations of the kidneys. 1-1, the two kidneys; 2-2, fibrous capsules; 3, pelvis of the kidney; 4, ureter; 5, renal artery; 6, renal vein; 7, suprarenal body; 8-8, liver, raised to show relations of its lower surface to right kidney; 9, gall-bladder; 10, terminus of portal vein; 11, origin of common bile-duct; 12, spleen, turned outward to show relations with left kidney; 13, semicircular pouch on which the lower end of the spleen rests; 14, abdominal aorta; 15, vena cava inferior; 16, left spermatic vein and artery; 17, right spermatic vein opening into vena cava inferior; 18, subperitoneal fibrous layer or fascia propria, dividing to form renal sheaths; 19, lower end of quadratus lumborum muscle.—(SAPPEY.)

Incisions for reaching the kidney, if carried too high, may open into the pleural cavity, the parietal reflection of which is represented by a line crossing the neck of the twelfth rib and the outer end of the eleventh.

**Relations of the Right Kidney.**—Anteriorly the right kidney is crossed in its upper half by the right lobe of the liver,

in its lower half by the ascending colon and descending duodenum, where they are uncovered by the peritoneum, the duodenum covering the inner quarter of the lower half. The suprarenal capsule at its upper end touches the liver. The peritoneum covers it anteriorly near the upper end, the tunica adiposa intervening.

Posteriorly the kidneys rest upon the crura of the diaphragm in front of the eleventh and twelfth ribs, the quadratus lumborum, and psoas muscles, from which they are

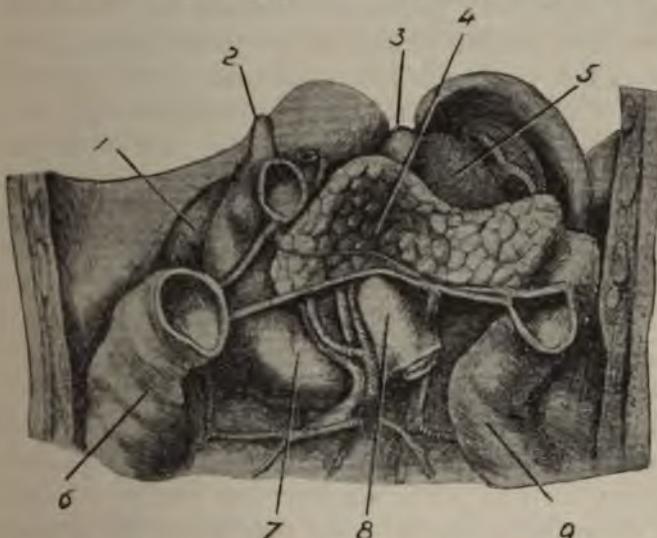


FIG. 4.—Relations of viscera (anterior view). 1, right kidney; 5, left kidney; 2 and 3, suprarenal capsules; 4, pancreas; 6 and 9, ascending and descending colon; 7, duodenum; 8, its junction with the jejunum.—(QUAIN.)

separated by the diaphragmatic fascia from the first, the anterior layer of the lumbar fascia from the second, and by the ilio-psoas fascia from the third. Behind it pass the twelfth dorsal, ilio-hypogastric and ilio-inguinal nerves. Externally the right kidney lies against the liver for its upper three-quarters. On the inner side are the arteries, veins and exit of ureters. The superior extremity is in contact with its suprarenal capsule, which rests on the upper and inner margin.

The relations of the kidneys are shown by Figs. 3 and 4.

**Support.**—Adipose and connective tissue (*tunica adiposa*) form the support of the kidneys, and, together with the blood-vessels, nerves, lymphatics, and ureters, hold them in position. The tunica adiposa itself is a thick layer of fat contained in the meshes of a loose areolar tissue, completely investing everywhere the fibrous capsule of the kidneys, but thicker and more abundant posteriorly than anteriorly.

**Dimensions.**—The long axis of the kidney is vertical and in length about four inches (10 centimeters), the width is about two and one-half inches, and the thickness one and one-quarter inches, varying in individual cases. The left kidney is usually slightly longer and narrower than the right.

**Weight.**—Each kidney weighs from four and a-half to six ounces (125 to 168 grammes) in the male and two or three drachms less in the female. The left kidney in both sexes weighs about 100 grains (6.5 gm.) more than the right. The specific gravity of the renal substance is 1.050, and it contains about 83 per cent. of water. In the child the kidney is  $\frac{1}{6}$  the body-weight ; in youths and adults  $\frac{1}{40}$ .

**Form.**—The form of the kidney is that of a haricot or kidney-bean, compressed from either side, presenting an anterior and a posterior surface, both of which are slightly convex, the anterior more so. The superior and inferior extremities of the kidney are somewhat wider than the middle of the organ, the superior being thick and rounded, while the inferior is thinner and more pointed. The external border is convex ; the internal concave, with a deep notch in the centre called the *hilum*, through which pass the vessels, nerves, lymphatics, and ureter. The hilum is the perceptible notch, but the cavity in the substance of the gland is called the *sinus renalis*.

**Color.**—The color of the kidney is red brown.

**Derivation of Vessels, Nerves, and Lymphatics.**—The arteries are derived from the aorta, the veins empty into the

rena cava, the lymphatics into the receptaculum chyli. The kidney is plentifully supplied with nerves from the solar plexus, the semilunar ganglion, and the splanchnic nerves. They completely surround the tubules and blood-vessels, and also communicate with the spermatic plexus. Dr. M. Holbrook has shown that every epithelium is in connection with a nerve-fibre, indirectly, through the inter-epithelial filaments of living matter.

As to the lymphatics, very little is known. In the capsule of the kidney there is a regular lymphatic system, and in the hilum several large lymph-vessels are found which are supplied with valves.

**The Tunica Adiposa.**—This has already been described under SUPPORT. The amount of fat in it varies according to the individual. In thin persons so much of the fat may be absorbed that the tunica adiposa becomes loose, and its connections with the kidney and surrounding parts so relaxed that the kidneys acquire no little mobility. In fat persons the size of the tunica adiposa may lead to erroneous conclusions as to the size of the kidneys themselves.

The fat-capsule is continuous with the subperitoneal fat-tissue—a matter of importance, as we shall learn further on.

**The Capsule.**—By this term is understood the fibrous capsule of the kidney, which lies everywhere under the fat-capsule (*tunica adiposa*), and from which the blood-vessels penetrate the kidney tissue. It is thin, firm, smooth, and closely fitting. Its composition is of numerous, firm, elastic fibres, which may be stretched or contracted to a considerable degree by the state of vascular tension of the kidney. It is connected with the organ by fine fibrillated connective tissue and minute blood-vessels. In the healthy state the capsule can be readily separated from the kidney.

In chronic interstitial nephritis, however, the connecting fibres undergo inflammatory thickening and increase in number, causing adhesion of the capsule to the kidney. The

capsule follows the notch or hilum in the renal substance, passes into the sinus of the kidney, and becomes continuous, around the bases of the papillæ of the pyramids, with the stronger external fibres and elastic tissues of the calyces and pelvis.

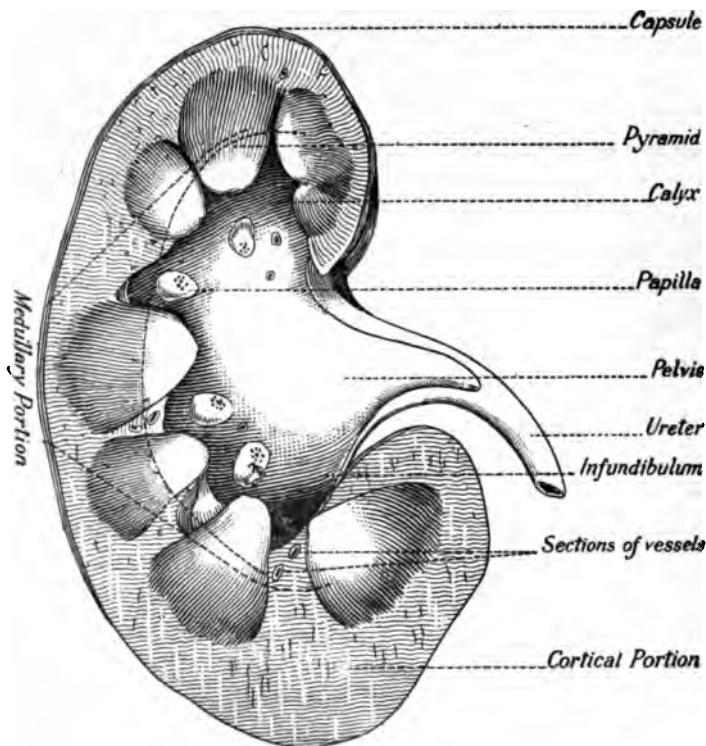


FIG. 5.—Section of the kidney showing gross anatomy.

**The Kidney Itself** consists of two portions, the *cortical* and the *medullary*. The thickness of the cortex, compared with the medulla, is as one to three. Fig. 5 shows the gross anatomy of a section of the kidney.

**The Cortical Portion of the Kidney.**—This lies directly under the capsule, and is the more vascular. It is about 6.25 mm. (about one-quarter of an inch) in thickness, and

sends prolongations between the pyramids, whose bases it surmounts, as far as the sinus.

These inter-pyramidal portions of the cortex are known as the *Columns of Bertini*, and mark the original divisions of the kidneys into lobules. The portion of the cortical substance which stretches from one column of Bertini to another, and which surrounds the base of the pyramids, is called the *cortical arch*. The columns and arches together form the *Labyrinth of Ludwig*.

**The Medullary Portion.**—This is divided into two parts—the boundary or intermediate zone or margin, and the papillary zone—and consists of from eight to eighteen conical masses, called Pyramids of Malpighi, whose bases rest on the cortical portion and whose apices converge toward the centre, where they form what are known as papillæ, which project into the calyces, which are the ultimate divisions of the pelvis. (The calyces are from seven to thirteen in number, and converge to form the three primary divisions of the pelvis called infundibula.)

The pyramids (Fig. 6) are plainly striated, these striations always being straight in the healthy kidney. They consist of (*a*) diverging blood-vessels, and (*b*) straight or collecting uriniferous tubules. The striations are prolonged into the cortex, where they are more prominent than in the pyramids, owing to the greater paleness of the epithelium. The red lines indicate the position of the blood-vessels, and the pale lines that of the uriniferous tubules, which, prolonged into the cortex, are known as the *Pyramids of Ferrein*, or *medullary rays*.

These alternating colors are known as the *markings of the cortex*. If they are straight, the kidney is healthy or the lesion confined to the epithelia only; if wavy or tortuous, a lesion involving the interstitial tissue is indicated, contraction having caused the vessels to deviate from a straight course.

The Tissues which concern us are three in number, namely :

1. The uriniferous tubules.
2. The Malpighian tufts and blood-vessels.
3. The intertubular structure (connective tissue, stroma).

**Synonyms.**—In studying the anatomy of the kidneys we find several terms used synonymously. The most important are the following :

*Glomerulus.*—The words tuft and Malpighian corpuscle are used synonymously with glomerulus. Some writers use the term Malpighian body or corpuscle, and confine the

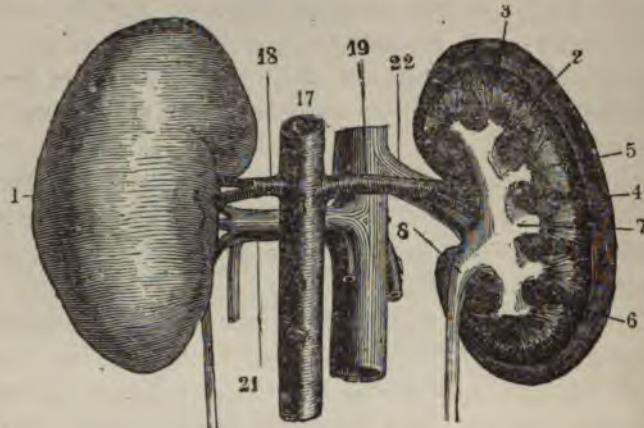


FIG. 6.—Shows a posterior view of the kidneys. The numbers represent the following: 1, left kidney; 2, section of the right kidney; 3, cortical substance; 4, columns of Bertini; 5, pyramid of Malpighi; 6, vessels; 7, calyces; 8, pelvis; 17, aorta; 18, renal artery (left); 19, inferior vena cava; 21, renal cava (left); 22, renal vein (right).—LITTRÉ.

term glomerulus to the capillary network within Bowman's capsule.

*Medullary Rays.*—Also called pyramids of Ferrein, pyramidal prolongations and lobules.

*Labyrinth.*—The region of the convoluted tubules, also known as the Labyrinth of Ludwig.

*Bowman's Capsule.*—Also called Müller's or the Malpighian capsule.

*Stellated Veins.*—Stars of Verheyen.

*Convolved Tubes of the First Order.*—Proximal convoluted tubes.

*Convolved Tubes of the Second Order.*—Junctional tubes, intercalated tubes, distal convoluted tubes.

*Spiral Tubes.*—Called also the spiral tubes of Schachowa.

#### THE URINIFEROUS TUBULES.

These begin in the cortical substance in small spherical bodies called Malpighian corpuscles (tufts, *glomeruli*), originating in the capsules of the tufts opposite the site of the blood-vessels, and, after uniting, terminate, considerably reduced in number, at the papilla of the pyramid. They are essentially of two kinds, *convoluted* and *straight*.

The capsule of the corpuscle (Bowman's capsule) becomes continuous with the tubules known as *convoluted tubules of the first order, or proximal*.

*Convoluted tubules.*—At the juncture of the capsule with the tubule there is a slightly narrowed funnel-shaped *neck*, and, after repeated convolutions within the labyrinth, the tubule tends toward the medullary ray. Here it becomes (to varying depths) *narrow*, often exhibiting *spiral windings* before decreasing in calibre, and represents the *descending branch* of the loop, or Henle's tubule. This enters the pyramidal substance, producing a distinct, angular divergence at the dividing zone between cortex and pyramid, in order to reach the bundles of the *vasa recta*. (See BLOOD-VESSELS.) After reaching certain depths in the pyramidal substance, the narrow tubule produces a *loop* (the loop of Henle), and takes an upward course as the *ascending branch* of then arrow tubule, this being, on the whole, slightly wider than the descending portion. Again the ascending branch widens, with short, irregular curves and angles (*the irregular portion*), and at the most peripheral part of the cortex, in which there exist no tufts, it resumes the width and aspect of the convoluted

tubule, being in this situation termed the *convoluted tubule of the second order* (*distal convoluted tubule or the intercalated tubule*), which inosculates with the *straight collecting tubule*. By the union of several intercalated and collecting tubules *arches* are formed. Henle insists upon the arched arrangement of the collecting tubules themselves, to which the intercalated tubules are joined. *The collecting tubule* occupies the centre of the medullary ray in the cortex. The groups of collecting tubes in the pyramid are situated between groups of the narrow tubules, decreasing in number, by continuous union at acute angles of analogous formations, until, lastly, a limited number of *wide collecting tubules* (eight to fifteen) open at the point of the pyramid—the papilla—which protrudes into the calyx. Their mouths are visible to the naked eye, and are called the *foramina papillaria*.

Fig. 7 shows the course and arrangement of the tubules.

**Summary.**—The essential things to remember about the uriniferous tubules are the following :

1. Bowman's capsule.
2. The neck.
3. The proximal convoluted tubules.
4. The spiral portion.
5. The descending limb of Henle's loop.
6. The ascending limb of Henle's loop.
7. The irregular tubules.
8. The distal convoluted portion.
9. The arched collecting tubules.
10. The straight collecting tubules.
11. The ducts of Bertini (wide collecting tubules).

**Situation of the Tubules.**—*The convoluted tubules of the first order* occupy the portion around the ascending branches of the renal artery, and their sum total is termed the *labyrinth of Ludwig*.

*The convoluted tubules of the second order* fill the most external portion of the cortex, in which there are no tufts.

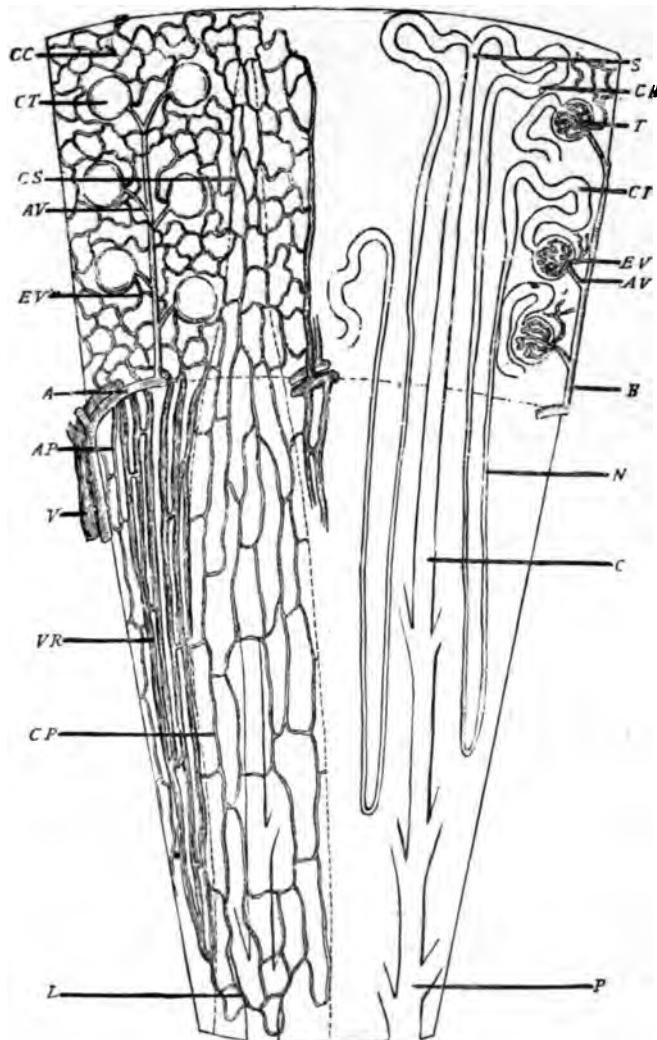


FIG. 7.—Diagram of the kidney. A, renal artery; V, renal vein; T, tuft; CT, capsule of tuft; AV, afferent vessel; EV, efferent vessel; CC, capillaries of convoluted tubules; CS, capillaries of straight tubules; B, arterial branch to the cortical substance; AP, arterial branch to the pyramidal substance; VR, vasa recta; CP, capillaries of the straight collecting tubules; L, capillaries of the papilla; CI, convoluted tubule of the first order; N, narrow or loop tubule; CH, convoluted tubule of the second order; S, straight collecting tubule in the medullary ray of the cortical substance; C, straight collecting tubule in the pyramidal substance; P, the same at the papilla.—(HEITZMANN.)

*The straight tubules*, both narrow (loop-tubules) and collecting, produce the medullary rays between the labyrinths in the cortex, while in the pyramids they run in separate bundles according to the following arrangement: First, the narrow tubules, together with the *vasa recta* (see BLOOD-VESSELS), in the imaginary prolongations of the labyrinth, and then the collecting tubules as direct prolongations of the medullary rays of the cortex.

The labyrinth, the medullary rays, and medullary portion of the kidneys, contain the following, respectively:

**The Labyrinth** contains :

1. The Malpighian bodies.
2. The constricted necks of the tubules.
3. The proximal convoluted tubules.
4. The irregular tubules.
5. The distal convoluted tubules.
6. The arched collecting tubules.

**The Medullary Ray** contains :

1. The spiral tubules.
2. The ascending limbs.
3. The straight collecting tubules.

**The Medulla of the Kidney** contains :

1. The descending limbs.
2. The loops.
3. The ascending limbs.
4. The collecting tubules.

**Epithelium of the Tubules.**—In a general way the epithelium is *cuboidal* in the convoluted tubules, *flat* in the narrow tubules, and *columnar* in the collecting tubules.

In the polyhedral epithelia of the convoluted tubules is a rod-like structure (Rods of Heidenhain). The striations and rod-like markings are most prominent in the irregular tubules.

Considered with reference to epithelia, we find the following :

Flat epithelia : capsule, neck, descending limb.

Polyhedral epithelia : proximal convoluted tubules, spiral tubules, ascending limb, distal convoluted tubules.

Very angular and markedly striated epithelia : irregular tubules.

Columnar epithelia : straight collecting tubules.

The polyhedral epithelia in the proximal convoluted tubules are somewhat triangular in character ; in the ascending limb cuboidal.

Charles Heitzmann described the tubules and their epithelia as follows :

"The *convoluted tubules* of the first order, having an average diameter of 0.0045 mm., are lined by polyhedral epithelia, the cement-substance between them often being ill-defined, or, especially in the kidneys of children, absent. In these epithelia R. Heidenhain discovered a rod-like structure similar to that observed in the epithelia of the ducts of salivary glands. The ascending and descending portions of the *narrow tubules* have a diameter of 0.0020 to 0.0025 mm., and are lined by cuboidal epithelia, which also exhibit the rod-like structure ; this peculiarity is particularly well marked in the irregular portions of the tubules. The descending portion gradually becomes narrow, and its epithelium passes by degrees into the flat variety, while the ascending portion often appears abruptly widened close above the loop, or in the depth of the loop itself. Along the course of the ascending tubule within the cortical substance the epithelium again may become flat, corresponding to a narrowing of the caliber. The narrow portions have a diameter of 0.0014 ; their caliber is comparatively wide, and the flat epithelia are finely granular and supplied with a distinct nucleus. In edge-view these epithelia appear spindle-shaped, closely resembling the endothelia of capillaries. The convoluted tubules of the second order have only a few convolutions ; their caliber is somewhat wider than that of the convoluted tubules of the

first order, their epithelia, however, being identical with those of the latter. In the irregularly-winding portions the epithelia show slight differences in their depths. The collecting tubules have the widest caliber, their diameter being, at the apex of the medullary ray, the same as that of the convoluted tubules, while in their course toward the papilla they gradually assume a diameter of 0.020 to 0.030 mm. Their epithelia are at first cuboidal, but with increasing caliber the

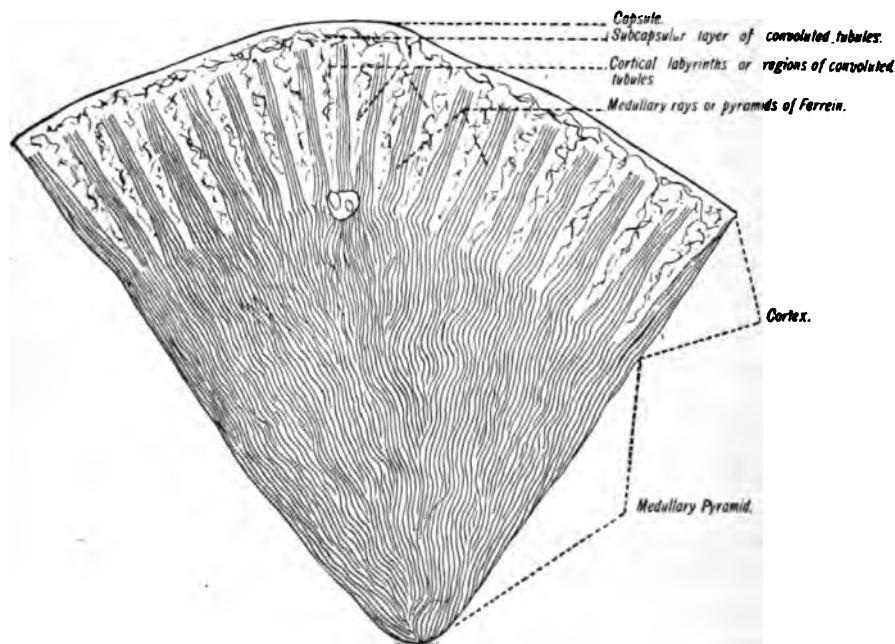


FIG. 8.—Diagrammatically exaggerated representation of the cut surface of a renculus (medullary pyramid and corresponding cortical arch).—(From HEKTOEN.)

epithelia become distinctly columnar, being finely granular and obliquely arranged in the lower portions, after the manner of shingles on a roof. According to C. Ludwig, the membra propria near the papillæ is fused with the surrounding connective tissue.

"All tubular formations of the kidney are ensheathed by delicate connective tissue, which carries the blood-vessels and nerves."

Considered with reference to urine forming and urine conducting, we find the following :

1. In the urine-forming tubes the epithelia have a well marked network, a delicate investing membrane, and are readily changed by disease.

2. In the tubes through which the urine is conducted the epithelia have a less developed network, a firm investing membrane, and are less frequently affected by disease.

#### THE MALPIGHIAN TUFTS AND BLOOD-VESSELS.

EACH uriniferous tube begins in a *glomerulus* (Malpighian corpuscle or tuft).

The Malpighian corpuscles are small spherical bodies, regularly arranged in rows in the edges of the pyramids of Ferrein in the cortical arches, and also irregularly scattered throughout the columns of Bertini. They vary from 0.25 mm. to 0.32 mm. in diameter, and are composed (1) of a connective-tissue *capsule*, rich in elastic fibres, lined with flat epithelia, and formed by an expansion of the basement membrane of the tubes, and (2) of a *network* of capillary vessels. The capsule is known as Bowman's, Müller's, or the Malpighian, and is reflected over the glomerulus, and often dips in between the individual blood-vessels.

The capillary network is formed by a small *afferent* artery (Fig. 9), piercing the capsule of Bowman and dividing into a number of convoluted loops, which unite to form an *efferent* vessel smaller than the afferent, and piercing the capsule very near the afferent. The capillaries differ from ordinary capillaries in that their walls are thicker, they are not lined by a continuous layer of endothelium, and their outer surfaces are completely covered by a layer of flat epithelia.

The convolutions of the capillary blood-vessels are arranged in two main lobes; hence the glomerulus is a bilobate formation of capillaries. (Fig. 10.)

The efferent vessel contains arterial blood, though the muscle-coat is very imperfect, or absent.

**Distribution of Blood-vessels.**—The renal artery is the largest, in proportion to the size of the organ supplied, of any



FIG. 9.—From the cortical portion of the human kidney. *a*, arterial twig giving off the afferent blood-vessel; (*b*) of the glomerulus (*c*', *c*'); *c*, efferent vessel of the latter; *d*, capsule of *Bowman* opening into a convoluted uriniferous tube of the cortex *e*.—(FREY.)

in the body. On entering the pelvis of the kidney it divides into several branches, which are termed arteriæ propriæ renales. These traverse the columns of Bertini, supply in part the medullary pyramids and afferent vessels of the Malpighian bodies in that region, and divide at the base of the pyramids into two sets of branches for the further supply of

the kidney—namely, the interlobular arteries and the arteriolæ rectæ.

The interlobular arteries pass directly outward between the pyramids of Ferrein and terminate in the capillary network of the capsule. From these arteries are derived the afferent vessels of the glomeruli of the cortical portion. The arteriolæ rectæ supply the medullary pyramids, whose substance they traverse, terminating at their apices.

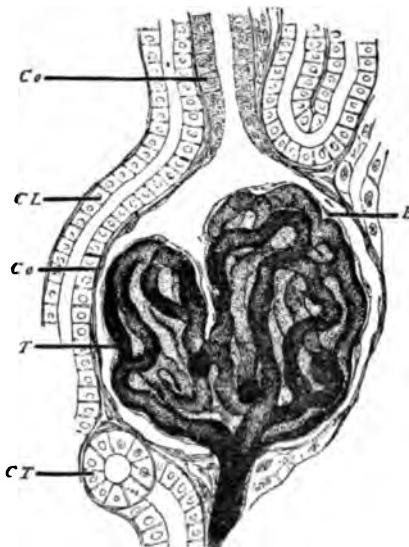


FIG. 10.—Tuft from the kidney of a dog. Injected. *T*, capillary loops of the tuft, in connection with the afferent artery, covered by *E*, flat epithelia; *Ca*, capsule, covered with flat epithelia, in communication with *Co*, the convoluted tubule; *CL*, convoluted tubule in longitudinal section; *CT*, convoluted tubule in transverse section. Magnified 350 diameters.—(HEITZMANN.)

The veins correspond to the arterial divisions. From the Malpighian corpuscle the efferent vessel divides into a network of capillaries, which surround the tubules of the cortical substance forming the intertubular plexuses, which, as they approach the cortex, form small veins. Those beneath the capsule are stellate in arrangement, and are called *the stellated*

*veins or Stars of Verheyen.* They pass downward, receiving branches from the plexuses about the tubuli contorti, and at the bases of the Malpighian pyramids join the venæ rectæ, which are derived from the plexuses at the apices of the pyramids and from the venæ propriae renæ. The venæ propriae renæ accompany the arteriæ propriae renæ between the pyramids, receiving in their course the efferent vessels from the glomeruli, and in the sinus of the kidney join with the veins from other pyramids to form the renal vein, which ultimately joins the inferior vena cava.

All the arteries and veins interlace and completely surround the tubules.

#### THE INTERTUBULAR TISSUE OR STROMA.

This is made up of a variety of connective-tissue elements. The fibres are most numerous in the vicinity of the blood-vessels and around the Malpighian corpuscles. They are more marked in the cortical portion than in the medullary, but occur in abundance near the apices of the papillæ.

The capillaries of the glomeruli are covered with fine delicate connective tissue, and the capsule is completely enveloped in it.

The loose connective tissue between the pyramids carries the larger blood- and lymph-vessels and the principal nerves.

The blood-vessels and uriniferous tubes are held together by a delicate fibrous connective tissue rich in elastic substance.

The capsule of the kidney is of dense fibrous connective tissue.

#### PHYSIOLOGY OF THE KIDNEYS, TOGETHER WITH CERTAIN PATHOLOGICAL CONSIDERATIONS.

The normal functions of the kidneys are to remove from the body excrementitious substances and water. The most

important excrementitious substances are those containing *nitrogen*, as urea, uric acid and the urates. How this is done has been the subject of much investigation and discussion.

**Theories of Secretion.**—There are two principal theories regarding the secretion of urine by the kidneys as follows:

I. The Bowman-Heidenhain theory, according to which the secretion of urine is due to the activity of two sets of epithelia. The flat epithelia covering the glomeruli take up water and salts from the blood and transfer them to the beginning of the uriniferous tubules. Their activity chiefly depends on the activity of the circulation of the blood through the capillaries. But they may be also excited to active secretion by the presence of certain urinary constituents in the blood, as water and salts, or possibly diuretics, like caffeine. The rodded cells of the convoluted tubules and ascending loop of Henle secrete specific urinary constituents, as urea and uric acid, and a certain amount of water; also certain abnormal constituents of the blood, as indigo-carmine. Their activity depends on the amount of urea and uric acid in the blood.

II. The modified Ludwig theory, which holds that the secretion of urine is a mixture of physical and physiological processes. In the glomerulus a physical process takes place, namely, a transudation of watery and crystalloid constituents (including urea) of the blood plasma. The extent and nature of this transudation is determined:

1. By the pressure in the capillaries of the glomerulus.
2. By the velocity of the flow through the capillaries.
3. By the permeability of the capillary wall and the glomerular epithelium.

This watery transudate is concentrated and altered on its way through the tubules in consequence of absorption of water, and probably of certain of its crystalloid constituents. This absorption must be due to the active intervention of the epithelia, since the osmotic pressure of the urine is considerably higher than that of the blood-pressure.

Diuretics may act in two ways. Salines increase the pressure and velocity of the blood in (?) the glomerular capsules, not only by increasing the volume of the circulating fluid, but also, probably, by direct dilator action on the afferent vessels of the glomerulus. Caffeine and theobromine have this action, and probably also paralyze the absorbing mechanism of the kidneys, that is, the epithelia of the convoluted tubules, so that the glomerular transudate may undergo little change in its way to the ureters and bladder.

**Influence of the Nervous System.**—This distribution of nerve-endings to the tubules suggests the possibility that the central nervous system may control the secretion of urine directly apart from its influence on the renal circulation.

**Important Parts of the Kidneys.**—These, from a pathological standpoint, are the capsules, including the fat capsule (*tunica adiposa*), the tubules, the glomeruli, the blood-vessels and the interstitial tissue, the pelvis and calyces.

#### PATHOLOGICAL CLASSIFICATION.

The kidney is subject to the following morbid changes: Malformations, malpositions, hypertrophy, atrophy, anemia, hyperemia, hemorrhage, thrombus, embolism, calcareous infiltration, uratic infiltration, argyrosis, biliary pigmentation, hemoglobin pigmentation, glycogenic infiltration, dropsical infiltration, leukemic infiltration, cloudy swelling or parenchymatous degeneration, fatty changes, amyloid degeneration, hyaline degeneration, inflammations (nephritis), together with the functional and organic disturbances resulting from them, tuberculosis, syphilis, leprosy, glanders, actinomycosis, tumors, cysts, and parasites.

The fat capsule is often the seat of abscess.

The fibrous capsule, normally easily separated, becomes strongly adherent in certain lesions, notably chronic interstitial nephritis.

The tubes and glomeruli become the seat of inflammation or degeneration in the various forms of nephritis.

The arteries are very often changed by disease. There is either thickening of one or of all of their coats, or they are the seat of waxy degeneration.

The interstitial tissue is often infiltrated with cells, or irregularly thickened by a new growth of connective tissue.

The pelvis and calyces are lined with mucous membrane which may become inflamed, and they themselves may be dilated.

**Disturbances of the Functions of the Kidneys.**—These are brought about by :

1. Rapid or slow changes in the tissues of the kidneys.
2. Changes in the quantity, the composition, and the rapidity of circulation of the blood.
3. Nervous influences affecting the quantity of the urine.
4. Diseases of the urethra, bladder, ureters, and pelvis of the kidneys.
5. Diseases of the lungs, heart, liver, stomach and intestines.

## CHAPTER II.

### PHYSICAL EXAMINATION OF THE KIDNEYS.

**Inspection.**—This will show a large tumor of the kidneys, particularly in the case of enormous cystic kidneys. In such cases the growth may fill one or the other lumbar region and the corresponding portion of the umbilical region. There will be bulging outward of the ribs on the affected side. The tumors which are most likely to be detected in addition to cystic kidneys are sarcoma in children, hydronephrosis, and paranephric abscess, the latter posteriorly.

In a case of enormous cystic kidneys which the writer saw the bulging was easily detected by inspection even when the patient was lying flat on his back.

A normal movable kidney is not perceptible upon anterior inspection.

**Palpation.**—The bowels should be moved thoroughly beforehand, either by cathartics or by a high enema. The patient is placed in the dorsal recumbent position with head and chest slightly raised, and the legs and thighs flexed. Breathing being natural, during respirations push the right hand in the direction of the lumbar region, while firm pressure is made with the left against the lumbar region. If the kidney is enlarged it will be felt during inspiration between the two hands. If the attempt is unsuccessful, put the patient on the opposite side and try again. In some cases success may be achieved when the patient is sitting or standing. (Senn.)

In cases of renal tuberculosis complicated by paranephric abscess there is well-marked swelling, which is fixed, and fluctuation can be made out by palpation.

Practically a kidney which is palpable is either movable or enlarged.

Laphorn Smith advocates the invariable use of the semi-erect posture of the patient in examining for floating kidney. The patient should stand, leaning slightly forward, with her

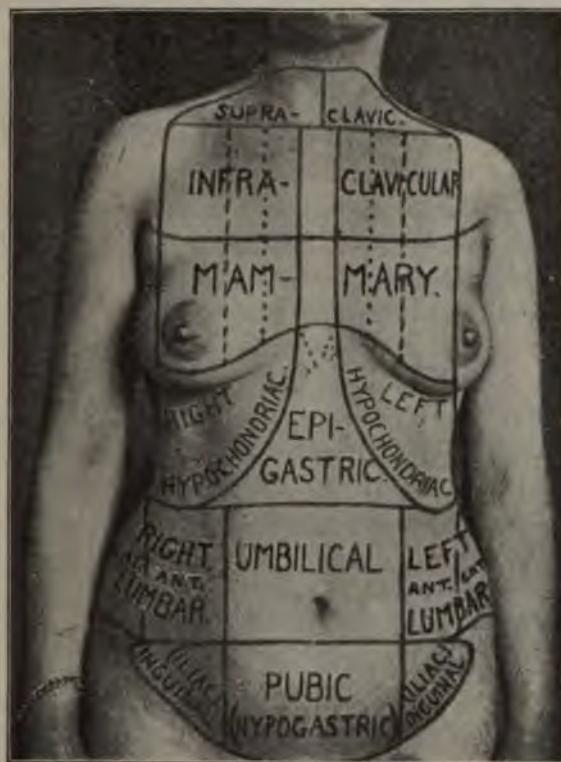


FIG. 11.—Showing nine topographical areas of abdomen. (After Joessel. Redrawn and modified by Butler.)

hands on the back of a chair, so as to relax the abdominal muscles, while the examiner sits to the right and a little behind.

In some cases the knee-elbow position is the best for discovery of movable kidney.

We distinguish (1) *palpable kidney*—one which is normal in size and position, the lower border of which can be felt when the abdominal walls are not too thick. (2) *Movable kidney*—one which can be felt to slip down so that its entire length can be felt, especially if it can be pushed down to the horizontal umbilical line, and (3) *floating kidney*—one which can be displaced into the lower half of the abdomen, pushed across the median line, or displaced in any direction.

Enlargement of the kidney may be detected by palpation anteriorly. In some instances the renal artery may be felt pulsating if the kidney can be seized. (Butler).

The normal kidney is felt as a smooth, oval, and half-elastic organ; in the case of growths it may feel smooth, soft, fluctuant, dense, uneven, globular, or lobulated.

The kidneys cannot always be palpated; they are best made out in the case of thin persons with flabby abdominal walls.

In the male the kidney can only exceptionally be felt; in woman the normal left kidney may be palpated in about 30 per cent. of the cases, the right in 75 to 80 per cent.

It should not be forgotten that the kidneys lie behind the peritonæum, and that they may or may not move with respiration.

**Percussion.**—The patient should lie upon the abdomen across a rather hard pillow. Anteriorly percussion reveals little or nothing.

Posteriorly only the outer and lower margins can be made out, on account of the proximity of the neighboring organs. This border is found about 10 centimetres (four inches) from the spinous processes, but only when the colon is filled with gas; if full of faeces or over-distended with gas the attempt to percuss the outer border will be futile.

The area of kidney dullness is between the twelfth rib and the crest of the ilium. The space is about 5 centimetres (two inches) broad, and it must be percussed sharply in order to be appreciated.

Anteriorly the dullness is abruptly exchanged for tympanic resonance as the intestines are approached.

Percussion is chiefly of service in two conditions: First, when the kidney is absent or dislocated; and, second, in large renal tumors. In the latter case a broad tympanitic strip will be found to run along the posterior or lateral portion of the tumor from adhesion of the ascending or descending colon. The dullness usually extends over the surface of the thorax.

If percussion dullness is *increased*, enlargement of the kidney is to be suspected; if *decreased* or absent, movable kidney.

**Auscultatory Percussion.**—By use of the phonendoscope (which is placed over the centre of the kidney or the tumor) and very gentle tapping of the abdominal wall with the finger-tips in a radiating direction from the instrument the outline of the body on which the phonendoscope rests can be made out with great precision by the impulse and pitch of the note conveyed to the ear.

Anterior auscultatory percussion as above is useful for confirmatory evidence in cases of tumors revealed by palpation.

**Tenderness on Pressure.**—This characteristic is of value in the diagnosis of the following conditions:

1. Acute nephritis. Paranephritis, especially noticeable.
2. Renal calculus, especially if inflammation result from it.
3. Hydronephrosis (usually).
4. Suppurative nephritis.
5. The writer found it in one case of renal haematuria in a haemophilic patient. (Diagnosis verified by operation).

**Rectal Insufflation.**—Procure a large rubber bag capable of holding four gallons of air, connect it with rubber tubing four to six feet long, and have a stop-cock near the bag itself. To the further end of the tubing attach the tip of an ordinary vaginal syringe, being careful to fasten it on securely. The patient assumes the dorsal recumbent position. The tip is inserted into the rectum, and one assistant presses the

margins of the anus against the rectal tube to prevent the air from escaping. Another assistant sits on the bag filled with air and placed on a chair, and turns on the stop-cock. The inflation is to be made very slowly and without interruption. The hands being placed over the sigmoid flexure, it is possible to feel the entrance of the air into the bowel. Continue the inflation until the cæcum is well distended.

Dulness having been outlined beforehand by percussion, the difference caused by inflation may be ascertained by repeating the percussion after inflation.

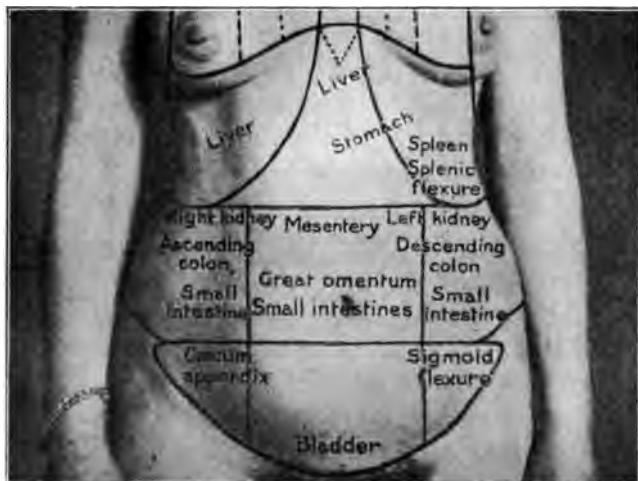


FIG. 12.—Showing roughly the contents of the nine topographical areas of the abdomen. (BUTLER.)

If the dulness disappears entirely after inflation the swelling is retro-peritoneal; if the dulness only partly disappears the tumor is intra-abdominal.

In this way an enlarged spleen may be differentiated from a tumor in the left renal region; if the colon be inflated and found to be in front of the tumor, the latter is renal and not splenic.

Inflation of the colon is often advisable for diagnostic pur-

poses, since the kidney, when enlarged by growths, usually pushes before it the ascending or descending colon against the anterior abdominal wall, which furnishes a tympanitic note.

**Physical Signs Furnished by Pathological Conditions.**—A number of pathological conditions furnish certain physical signs of significance as follows:

**Paranephritis with Paraneprhic Abscess.**—A circular symmetrical swelling between the borders of the ribs and the brim of the pelvis, extending posteriorly toward the spine, with œdematous condition of the skin and tissues beneath it and tenderness on pressure.

**Movable Kidney.**—Palpation reveals movable kidney by its form, mobility, size, capability often of replacement, and occasional pulsation of the renal artery.

Movable left kidney is differentiated from movable spleen by palpation and percussion. Palpation reveals characteristic notches in the spleen, but pulsations of the renal artery by deep pressure at the hilum in the kidney.

**Large Formations.**—Carcinoma, sarcoma, hydronephrosis, pyonephrosis, paranephritis and echinococcus may be all plainly palpable. Likewise cystic kidneys.

The tumors of hydronephrosis, pyonephrosis and echinococcus are large, rounded, globular and sometimes fluctuating. Large cystic kidneys can be felt as rounded masses; malignant tumors may be so large as to fill one-half the abdomen. They may be somewhat movable, and if of rapid growth a sense of fluctuation may be apparent.

Paranephric abscess shows distinct evidence in some cases of a tumor, in others a bagginess or induration in the interval between the last rib and the crest of the ilium, tending to bulge backward and become palpable posteriorly.

In some cases of the above large formations it may merely be evident that the kidney is enlarged, or that there is an obscure swelling or sense of resistance anteriorly, or a bulging and indistinct swelling posteriorly.

**Echinococcus.**—A peculiar whiz known as the hydatid vibration is shown by quick, short, bimanual percussion strokes.

**Respiratory Mobility.**—As the kidneys move but slightly with respiration, pronounced respiratory mobility, as a rule, excludes the kidney.

**Capability of Replacement.**—If the tumor is capable of replacement so that it disappears, it is thus proved to be renal.

**Differential Diagnosis Between Renal Tumors and Those of Other Organs.**—Renal tumors, according to Stiller, present the following characters :

1. Unilateral occupation of abdomen.
2. Spherical contour.
3. Downward growth. (Palpation reveals lower margin.)
4. Absence of any influence of the rhythmical movements of the diaphragm in breathing, when the tumor is fixed against the abdomen.
5. Relation to intestines : intestines lie over small tumors ; in larger ones, are pushed toward median side.
6. Presence or absence of tympany depending on amount of intestine covering the tumor.
7. Bulging posteriorly.

## CHAPTER III.

### GENERAL CLINICAL FEATURES OF RENAL DISEASES.

BEFORE considering the various renal diseases in detail, attention must be paid to the general clinical features of patients suffering from disorders affecting the kidneys. Inasmuch as in some cases the condition of the urine is the most salient feature, we shall consider this first.

**The Urine in Renal Diseases.**—One of the most significant changes in the urine when kidney disease is present is an unaccountable alteration of the ratio of day urine to night. Normally this ratio is three or more to one. In many cases of renal disease, however, the patient voids nearly as much urine after going to bed as during the entire time he is up, In severe cases of nephritis more urine may be voided during the night than during the day.

Alterations in the quantity of urine for the 24 hours are common. The patient with renal disease is likely to pass too much or too little urine. The color is likely to be too light or too dark. The specific gravity is likely to be too high or too low. It is seldom that we find in a well-marked case of renal disease urine normal in day and night quantity, appearance, color, odor and specific gravity. In the few cases, however, when the above physical characteristics are normal, the finding of albumin and tube-casts will reveal the presence of the disorder. A suspicious sign also is the unaccountable voiding of scanty urine of pale or light color. Normally, when the urine is deficient in quantity the color should be deeper in tint ; in many cases of nephritis a decrease in the quantity of 24 hours' urine is attended by a hardly perceptible change in the color. It goes without saying that light-colored urine which foams abundantly is likely to contain albumin.

A patient who voids alternately large and small quantities of urine should have his attention called to the possibility of the presence of renal lesion, even if no other significant symptoms are present. Women with hydronephrosis may show it only by this alternation in the quantity of urine. Cases of hysteria, of course, present an exception.

The finding of blood, pus, and crystals in the urine is often indicative of some malady of the kidneys, though in many diseases elsewhere in the urinary tract we may encounter these constituents.

The relation of albuminuria to diseases of the kidneys is here to be considered. It may be said in general that albuminuria, *however slight*, if not due to the presence in the urine of pus, blood, leucorrhœal, seminal or prostatic fluid must be considered a sign of renal disease. The disease may be latent, and not evident in other ways. The writer has, however, observed the presence of albumin in the urine in the case of young men after sexual excitement. It may, in these cases, possibly be due to admixture of prostatic fluid or be referable to slight congestion of the kidneys. The urine contains numerous mucous casts and bands, but no genuine casts, and is otherwise normal.

Children frequently have an albuminuria without casts which disappears as they grow older. I cannot recall any case of this kind, without casts in the urine, which has since developed into a nephritis without other known cause.

Senator insists that albumin occurs physiologically in the urine. This may be true in the case of children, but in the writer's experience many otherwise unaccountable albuminurias are referable to prolonged sexual excitement, and it is a significant fact that the so-called physiological albuminuria is especially noticeable in the young.

It is quite common among unmarried men who are addicted to sexual excess or subjected to sexual excitement.

Those who believe in physiological albuminuria classify it as follows :

Dietetic (following ingestion of certain kinds of food, as cheese, eggs, pastry), after exertion (severe and prolonged), and simple persistent, without other symptoms or known cause.

It is possible that a mistake has been made by some who rely on the so-called "delicate" tests for albumin which the writer has shown to react with alkaline carbonates in the urine. Even trichloracetic acid gives a ring with urines free from albumin, but containing alkaline carbonates in abundance. Proof of this can be had by adding strong solution of calcium chloride, filtering, and noticing absence of the ring after filtration.

In one case in which albumin was undoubtedly present in the otherwise normal urine of a young man, the writer was urged by a life insurance agent "to break the news" to the patient's family. It was ascertained, however, that the young man was engaged to be married, on the strength of which information the writer refused to alarm the family. Not long afterward the patient married and since then albumin has disappeared. Ten years have failed to demonstrate the existence of nephritis in this case, the individual in question being still alive and in good health.

P. Edel (*Munch. Med. Woch.*) has carefully observed the phases of cyclical albuminuria in three cases and from the study of these cases has drawn certain conclusions: The patients all presented the same clinical picture of nervous, weakly, non-resistant body habit, without any organic lesion save that producing the albuminuria, which varied according to the position (standing and lying), and had its maximum intensity during the forenoon. He found that after the "mid-day" dinner (taken at various hours) the albuminuria disappeared, to reappear again in the evening. He caused the meal to be passed over, and no diminution of the albuminuria took place. He next employed a diuretic (Potassium acetate), and observed the effect in conjunction with fasting. The

urine became alkaline and free from albumin. The quantity of urine appeared to have a direct connection with the presence or absence of albumin. In free diuresis the urine was pale, and there was no albumin, while when the urine was sparse the color was dark, and albumin was found usually up to 0.4 per cent. The effect of hot baths was relatively the same. Turning his attention to the pulse, he found that in the morning, while the patients were getting up, and especially during washing, the pulse was very small, but this change was not to be noted during the same movements in the afternoon or evening. The pulse volume, representing the amount of resistance in the arteries, was directly in proportion to the amount of albumin secreted at the time by the kidneys. Turning this to therapeutic use, he watched the effect of marching, in soldierly fashion, up hill, and even up mountain. Carrying this out, short of fatigue, he succeeded in producing a secretion of pale urine, free from albumin. The *rationale* of this treatment lay in the calling forth of systematic exercise on the part of the heart. He obtained good results when he ordered a very nourishing and sustaining diet in concert with mountain climbing, and claims that after a time these results were permanent. In connection with this subject, he mentions that the same procedure has proved beneficial in certain cases of true nephritis, although he adds that he has only been able to observe the effect during a relatively short period. (*New Albany Medical Journal.*)

Patients who have albuminuria should avoid asparagus, strong tea and coffee, sharp spices and acids.

The case is, however, far more significant and serious when *tube-casts* either with or without albumin are found. Diligent search may reveal occasionally a small hyaline cast or two in the urine otherwise normal and in the individual really healthy. When, however, half a dozen casts of any kind or of different kinds can be found in half a fluid ounce of urine, the chances are greatly in favor of the existence of

some kind of renal disease, especially if at the same time there is albuminuria, however slight, and still more so if the ratio of day to night urine or the physical characteristics of the urine are unaccountably abnormal.

*A trace of albumin and a few tube-casts* in the urine of men over fifty years of age may, however, be present for years without interfering with the health or comfort of the individuals concerned, as shown by Osler. But when in addition we find decrease in the ratio of day urine to night, persistent low specific gravity of the urine together with cardio-vascular or retinal changes then the condition becomes serious.

**The Patient in Renal Diseases.**—We must next consider the features other than urinary presented by the patient with kidney disease.

We find various physical characteristics of the individual : Those of the uric acid diathesis and its liability to renal changes are a robust, well-developed body, florid face, thick hair, good teeth, hearty appetite, good digestion and strong heart with high-pressured arteries ; a *waxy pallor* on the other hand is common in various forms of nephritis ; *cyanosis* is observed in some cases of chronic renal congestion ; *slight jaundice or sallowness of the skin* may be observed in waxy degeneration of the kidneys ; a *peculiar light fawn color* to the skin has been noticed by the writer in several cases of contracting kidney.

*The pulse* is often significant in cases of renal disease when attended by cardio-vascular changes ; for example, *the slow, tense pulse* in contracting kidney, the *rapid feeble arrhythmic pulse* in cases where the heart is dilated. In mild, slow cases of contracting kidney the pulse is often *slightly arrhythmic*, but not noticeably tense. *Loss of muscular strength* is often the only feature complained of by patients in the early stages of chronic renal disease. *Extreme weakness, pallor, edema, or general anasarca and difficulty of breathing* are well-known symptoms of severe renal disease.

In some cases *dizziness or vertigo* may be the first noteworthy features. Headache is of prime importance as a symptom, especially when occipital.

The various forms of Bright's disease present, when advanced, very characteristic physiognomies: those of *acute Bright's* and chronic non-indurative, formerly called parenchymatous, nephritis being often quite pathognomonic.

In early stages, the patient may appear above more than below proper standard of health; as the disease advances characteristic puffiness of eyelids appears. This puffiness is extremely important and suggestive when encountered in a man under 60 years. It varies greatly at different times of the day. In early morning eyelids may be distinctly dense, somewhat paler than remainder of countenance, may show a certain curious translucency. As the day advances lids become more baggy, but by afternoon or evening this will have disappeared and the thin skin have fallen into fine deep wrinkles.

In interstitial nephritis, marked edema is not to be expected early in the disease. When it does occur it is usually secondary to cardiac weakness and presents features of the edema of heart disease.

*Vomiting* is noticed with surprising frequency in cases of injury or disease of the kidneys; *gastro-intestinal disturbances* in general may be the most marked features in a given renal case.

## CHAPTER IV.

### ANOMALIES OF THE KIDNEYS.

We distinguish the following anomalies :

1. Anomalies of position.
2. Anomalies of form.
3. Anomalies of size.
4. Anomalies of number.

#### I. ANOMALIES OF POSITION.

These are three in number, namely :

1. Fixed.
2. Movable.
3. Floating.

#### FIXED MISPLACEMENTS.

These are either congenital or acquired. *The congenital displacement* is more frequent in men than in women, and affects more commonly the left kidney, being associated with an abnormal arrangement of renal vessels, ureter, and large intestine. The kidney is not only misplaced but frequently misshapen, and the suprarenal capsule only occasionally accompanies it, more frequently remaining in its natural position.

The presence, however, in the renal substance of aberrant portions of suprarenal tissue is a malformation of great importance, as it is not rarely the starting point of renal tumors.

Cases have been known to occur in which one kidney has been found over the sacro-iliac synchondrosis, between the bifurcation of the abdominal aorta, or in the hollow of the sacrum.

The two kidneys have been found on the same side, in which case they are usually located lower than the normal.

*Acquired displacements* result from various causes, among which we find :

1. Pressure from a tumor or an enlarged neighboring organ.
2. Tight lacing.
3. Sudden blows or jar, with subsequent inflammatory adhesions.

The other two misplacements (movable and floating) may be grouped under the heading

#### WANDERING KIDNEYS.

We distinguish two classes :

1. Movable : often very painful, and a source of great irritation.
2. Floating : often congenital, and one which may or may not give rise to symptoms.

Movable kidney is fifty times as common as floating kidney, but both may exist in the same person. The right kidney is much oftener displaced than the left.

**Synonyms.**—Floating kidney, movable kidney, nephrop-tosis, ren mobilis.

Dystopia of the kidney is the term used for an unmovable displacement of the organs which is usually on the left side.

**Etiology.**—Movable kidney is commonly due to the following causes :

1. Distention and relaxation of the abdominal walls as a result of pregnancy.
2. The influence of clothing as tight waist bands and corsets.
3. General enteroptosis of which it is a part : gastrop-tosis, coloptosis, and corset liver may be associated with uterine displacement.
4. Congenital predisposition and nervous influences as in diseases of the generative organs in women.

Other and probably less important causes which have been assigned are the following :

Trauma involving the region of the kidneys, emaciation with loss of perirenal fat, diseases of neighboring organs, severe physical labor with frequent tension of the abdominal muscles; childbirth with its accidents; spinal curvature; alterations in intra-abdominal pressure; tumors of the liver, spleen, or pancreas; effusions; mal-assimilation and imperfect development. Increased weight of the kidney from cancer or tuberculosis may cause it. It is found in women who have tabes dorsalis.

Movable kidney frequently occurs in women who do not wear corsets at all.

According to M. L. Harris the usually mentioned etiologic factors of movable kidney have little or no influence. The essential cause lies in a particular body form. Reliable results are obtained by dividing the jugulo-symphysis distance by the abdominal circumference at the level of the lowest point of the tenth rib. A more accurate index still is obtained by dividing the lateral diameter of the lower plane by that of the upper plane bounding the middle zone of the body cavity. The chief characteristic of this body form is marked contraction of the lower end of the middle zone with lessened capacity. This depresses the kidney so that the constricted outlet comes above the center of the organ and all acts, as coughing, lifting, etc., which adduct the lower ribs, press on the upper pole and crowd it still further downward. Repetition of these internal traumas gradually produces movable kidney. It is never the immediate result of external trauma.

Movable kidney is due to increased laxity of its attachments, in turn due to a diminution in the amount of fat surrounding it, or to detachment of the peritonæum from the muscle. We find several classes of cases:

1. Those in which the fat capsule is large and loose, allowing movements of the kidney within it.
2. Those in which the fat capsule closely surrounds the kidney and moves with it.

3. Those in which the kidney moves within the fat capsule, and the capsule also moves about with the kidney behind the peritonæum.

The degree of mobility varies considerably and is always limited by the length of the renal vessels.

Floating kidney, on the other hand, depends on an irregularity of the disposition of the peritonæum (a fold of this membrane completely enveloping the kidney so as to form a mesonephros, allowing the organ to float about in the abdominal cavity in any direction), or else on some abnormal arrangement associated with malposition of the colon, the kidney being left unsupported and free to move between diverging processes of the peritonæum.

The kidney may fall below the brim of the pelvis, or as far forward as the anterior abdominal parietes, or across to the opposite side of the spinal column. A case is on record in which the kidney moved under the peritonæum, through a space described, as a circle, with a diameter of eight or nine inches.

**Occurrence.**—It occurs more commonly in women and especially in women who have had children, usually between the ages of twenty and fifty. It may occur in young women of the chlorotic type in combination with nervous, digestive and nutritive disturbances. Children and infants are not exempt from it.

The right kidney is more often affected because it is less firmly fastened, placed lower and affected by the great mass of liver above it.

**Onset.**—It may appear suddenly, but the majority of cases require months or even years for full development.

**Clinical History.**—There is usually a history of severe physical labor with frequent tension of the abdominal muscles in women who have borne children, or of a severe wrench or lumbar strain. Cases have been known to develop after sea voyages where the patient has vomited and lost flesh from sea sickness or become emaciated from other causes.

**Physical Examination.**—The kidney is deficient in its proper means of fixity and must be deemed abnormally movable under any of the following conditions:

1. When the whole kidney descends during deep inspiration below the examiner's fingers on deep palpation.
2. When the greater part of the kidney so descends as to be felt between the two hands.
3. When the lower half of the organ so descends, and can be so felt. In the cases in the third group, and in some of those in the second, the organ can not be retained between the fingers, but slips back again on expiration.
4. When the kidney is out of position during natural respiration, and may be easily felt. This constitutes the so-called "floating kidney."
5. When the kidney moves horizontally, upon the plane of the posterior parietes, and does not drop forward or inward. (Morris).

Goelet believes that the examination for the detection of a prolapsed (movable) kidney should be made with the patient standing and with the body inclined slightly forward so as to relax the abdominal muscles. The examiner sits in front and a little to the right of the patient, grasps the right loin with his left hand, with the four fingers behind the right lumbar region and the thumb in front just below the border of the ribs. The patient is now directed to take several deep inspirations and to expire to the extreme limit. When expiration is complete he presses the thumb well into the abdominal wall under the ribs, depressing it as much as possible so as to reduce the space between it and the fingers posteriorly. If the kidney is out of position, it must be below his thumb, and he can feel the kidney slip into position as it is pushed upward by the fingers of the right hand. His observations have led to the following conclusions, viz.: (1) That prolapsed kidney is more frequent than is generally supposed; (2) that it is often not suspected, because it does not always give rise to symptoms directly referable to the kidney; (3) that frequently it is not discovered because, by the usual methods of

examination, only an expert can detect it unless the kidney is much enlarged or the subject is thin and the abdominal wall relaxed.

**Cardinal Symptoms.**—There may be no symptoms at all in the case of movable kidney, but the most common feature is *pain* more or less local, but often radiating into the epigastric, sacral, or lumbar region, usually dull and dragging, but at times, and especially during the menstrual period, colicky. The pain is not rarely associated with *nausea*.

**Clinical Features.**—In general we find in the earlier stages the following :

1. Digestive disturbances. Common in nearly all cases, including constipation.
2. General nervousness, and serious mental anxiety.
3. Epigastric pain to the left of the median line.
4. Cardiac palpitation.
5. Inability to sleep or to be comfortable on the left side.

In later stages as follows : pain prominent, due to chronic localized peritonitis or neuralgia of the lumbo-abdominal nerves; anorexia, nausea, sometimes vomiting, vertigo, anaemia, menstrual disturbances, occasionally renal or uterine haemorrhages, despondency, occasionally icterus, and attacks like renal or biliary colic. Vomiting may occur without pains or nervous symptoms. A dislocated organ is extremely irritable, and the reflex and symptomatic phenomena are chiefly due to this irritation.

Movable kidney greatly aggravates a gouty condition.

*Clinically* we may classify the symptoms as (1) painful ; (2) dyspeptic ; (3) neurasthenic. The pain is aggravated by motion, or by riding and driving. During rest it becomes slight or entirely disappears. Periodically, as above stated, the attacks of colic (Dietl's crises) occur. There is an onset of violent pain with chilliness, slight fever, great tenderness and tension of the abdomen, vomiting, and collapse.

The pain is caused by torsion or bending of the ureter, and

the latter leads to an acute hydronephrosis, or even to a chronic condition of this sort, and secondary pyelitis.

The patient will generally complain of a "dragging" sensation on the affected side.

The kidney is most readily found to be movable by catching it during a deep inspiration and palpation with deep pressure will make the patient complain of nausea or of a deathly faint feeling.

Since gall-stones are common in women with enteroptosis and corset liver, it may be possible to find the kidney movable during attacks of biliary colic, but intestinal obstruction and jaundice due to it are rare. When there are hepatic symptoms the latter are exceedingly intractable.

This is so much the case that when a patient has severe hepatic symptoms, short of jaundice, and the ailments do not yield to ordinary treatment, one should at once suspect that the hepatic condition is being continued by the reflex disturbance of a mobile and displaced kidney, and all efforts should be redoubled to detect it. Unless the kidney is kept in position by a belt, or (in condition of excessive mobility) by operation, the attacks will recur.

A peculiar symptom, and one said to be quite diagnostic, is that women who have borne children state that they experience less trouble during the latter half of pregnancy than at any other time, and have rapid return of the pain and distress soon after the child is born.

*Hematuria* is rarely noticed in movable kidney. In one case reported by A. T. Cabot severe threatening hematuria occurred which was finally controlled by nephropexy.

**Causes of the Pain and Disturbances.**—The dilatation of the stomach is attributed to direct pressure of the kidney on the pylorus or duodenum. The hydronephrosis and pyonephrosis may be produced by a twist of the ureter. The attacks of abdominal pain, etc., collapse, chills, fever, and the like, with scanty and possibly bloody urine, have been

attributed (1) to circumscribed peritonitis from an incarceration of the kidney in the peritonæum surrounding it; (2) to acute hydronephrosis from compression or twist of the ureter; (3) a disturbance of circulation in the kidney caused by obstruction of the renal vessels, especially the vein, in consequence of a displacement or twist of the movable or floating kidney.

**Effects.**—These are dilatation of the stomach (rarely prolapse of the stomach), gall-stones, due to partial obstruction of the common duct by the pedicle; hydronephrosis, death from complete strangulation due to torsion of the vessels and ureter, and a condition simulating aneurism by dragging on the abdominal aorta and kinking of the vena cava. Chronic appendicitis may be dependent on movable right kidney.

The *mental state* is one of irritation, despondency, chagrin, and melancholy over inability to work. Death from these and digestive disturbances occasionally takes place.

*Clinically* we find the most frequent effect of movable kidney to be *hydronephrosis*, either intermittent or constant.

Movable kidney exhibits a tendency to carcinomatous degeneration.

**The Urine.**—In cases where the movable kidney is nephritic, albumin and casts will be found in the urine. Otherwise in the majority of cases the urine is normal. During Dietl's crises, when the ureter is badly strangulated or kinked and its lumen temporarily constricted, the urine is scanty, high-colored, and may contain blood corpuscles, uric acid, and oxalate crystals. More or less albumin may also be found at such times.

Simultaneously with the oliguria swelling of the kidney from hydronephrosis may take place, followed by an excessive flow of clear urine with subsidence of pain and swelling.

**Differential Diagnosis.**—The following conditions are most often to be differentiated :

1. Retained fæces.

2. Dropsical gall-bladder.
3. Tongue-shaped appendage to the right lobe of the liver from constriction or growth.
4. Pedunculate tumors of uterus or ovary.
5. Cancer of the stomach or intestine.

The use of laxatives or the flushing of the colon will serve to distinguish the first.

The second, third, and fourth are distinguished by the inability to replace them in the region of the kidney. Moreover, in the case of tumors connected with the liver, the location is more constantly superficial, and the degree of mobility more largely controlled by that of the diaphragm.

The severe digestive disturbances will soon differentiate cancer.

When the disease simulates some affection of the genital organs in women the following should serve to distinguish movable kidney :

1. Disorders of digestion, accompanied by pain, not only in the right side, but more especially in the left. These pains may be characterized as cardialgia or gastrodynia.
2. General nervousness, the transforming of a naturally sweet temper to irritability, with loss of sleep.
3. Palpitation of the heart, coupled with pain over the cardiac end of the stomach.
4. The usual symptoms directly due to the displacement of the kidney, together with the marked emaciation so strong an etiologic factor of floating kidney. (Smith.)

The symptoms may suggest, at the crises, tabes dorsalis, pregnancy, intestinal obstruction hysteria, uncomplicated neurasthenia, and poisoning.

The nervous symptoms may be mistaken for hysteria or hypochondriasis.

Malignant tumor of the ascending colon has been mistaken for movable kidney. (Owen.)

The pains of indigestion, biliary colic, appendicitis, and

other gastro-intestinal disturbances must not be mistaken for that of movable kidney.

In women of a highly nervous temperament who drink but little water the kidneys are sometimes sensitive to pressure. (Hartman.)

Hartman calls attention to the possibility of mistaking tumors involving the omentum for movable kidney, as also a distended gall-bladder. Patients sometimes complain of the pain of movable kidney most during the menstrual period and occasionally only during the period, so that it must not be mistaken for dysmenorrhœa.

Tumors of the spleen may be mistaken for movable kidney. (See previous chapters.)

*Clinically* we find the commonest error is to mistake an enlarged gall-bladder for a movable kidney.

Movable right kidney is to be differentiated from a distended gall-bladder: if it is the kidney it will be freely movable in all directions, may be carried down toward the pelvis and held there during forcible expiration; may be pushed backward and upward toward its normal position, where it tends to remain and elude further palpation; moves slightly if at all with respiration, and an area of tympanitic percussion (colon) may be found between it and the costal margin.

The gall-bladder on the other hand moves with respiration and is not so freely movable as the kidney, though it may be moved from side to side or in various radii of a small circle having its neck for a centre; and if pushed backward away from the abdominal wall, tends to spring forward to its former position when the pressure is removed. Lastly, if the colon above which it usually lies has not become looped over its neck, there is no tympanitic band between it and the lower border of liver dullness. (Butler).

The *floating kidney*, when found out of place, may lie as low as the brim of the pelvis, or on the opposite side of the

median line, or directly beneath the anterior abdominal wall. As a rule, it is readily returned to its normal position.

**Associated Maladies.**—In women abdominal pelvic conditions usually co-exist with wandering kidney, as follows :

1. Displacements of the uterus.
2. Oöphoritis.
3. Salpingitis.
4. Inter-menstrual uterine haemorrhage.
5. Prolonged and profuse menstruation.
6. Elongation of the blood-vessels of the kidneys, curved ureter, hydronephrosis and pyonephrosis, limited twists of the ureter and vessels, and adhesions to the transverse colon or liver may be found associated with movable kidney in either sex.

**Prognosis.**—As regards relief from permanent mobility the prognosis is favorable ; the relief may be brought about as follows :

1. By accumulation of fat-tissue.
2. Owing to pregnancy.
3. The result of mechanical or surgical treatment.

As regards relief from the symptoms (chlorosis, neurasthenia, hypochondriasis, and mental distress), the prognosis depends on the ability of treatment to fix the kidney and that of the patient to appreciate intelligently the significance of movable kidney. If climacteric is present or approaching it is possible that the symptoms may disappear afterward.

Movable kidney is sometimes nephritic. Use of the peculiar ureteral catheter called the segregator will determine whether the nephritis is confined to the one kidney or is present in both. In the latter case no operation can usually be advised and the prognosis is more serious.

**Dangers.**—These are as follows :

1. Hydronephrosis.
2. Pyonephrosis.

These are constantly a source of danger ; add also

3. General peritonitis—occasionally.
4. Destruction of the kidney eventually from degeneration (chronic interstitial nephritis) or malignant disease.
5. Various intercurrent diseases.

**Treatment.**—In cases where an operation cannot be performed, rest should first be tried, no muscular strain whatever being allowed. Occupations requiring an upright position not permitted, and bicycling particularly forbidden.

The physician should cautiously attempt to replace the kidney.

Place the patient on his back and gently push the kidney into place. If the kidney has been forced out of position by some strain, enforced rest in the recumbent position should be attempted. Next in order, bandaging should be tried.

The best bandage is made of silk elastic closely fitted to the whole abdomen, and prevented from riding up by means of straps of soft rubber tubing or other material, one on each side, passing from back to front between the legs. Over the position of the dislocated kidney is sewed on the inside of the bandage a round pocket of soft chamois-skin, left open above so that a pad can be pushed into it and changed on occasion. (Fitz.) The measurements from which the belt is made should be carefully taken, and the pad must be large enough to fit the lower quarter of the abdomen so as to make pressure backwards and support the kidney.

In highly nervous patients rest with forced feeding may suffice for treatment in case the kidney is but slightly movable.

The abdomen should be sponged daily with cold water or with brandy. Faradism may be tried, one pole in the vagina, the other over the region of the kidney. Mechanical massage of the abdominal muscles and organs is sometimes successful.

Gallant earnestly recommends the use of the *corset* in movable kidney in preference to operation, as follows:

For routine examination the hand is placed just below the

hypochondrium and the kidney displaced by deep inspiration, held and palpated, and allowed to escape during expiration. In some cases for the bimanual examination the dorsal or the upright inclined posture will prove more satisfactory. Some of these cases require operation, but 90-95 per cent. can be cured symptomatically by wearing a corset. A corset must be secured as long in front as can be worn, to elevate and support the redundant lower abdominal wall, and form at the waist line a shelf on which the kidney may rest. The best results, symptomatic and modish, are secured when the corset is "made to order," but the so-called "straight-front" corset, now on sale in every shop, has given very good results.

The corset must be not less than two inches smaller than formerly worn, laced at the back, from the top and bottom, with two flat laces, as an open V, to prevent chafing and cutting in thin women, and must be laced very snugly from the lowest point to the waist line, loosely from the waist upward, while the patient is standing.

Having thrown the corset around the waist, she lies down on the bed, draws up the knees, places the head upon a pillow to relax the abdomen and permit the viscera to gravitate upward toward the diaphragm, and while in this position fastens the corset. Before hooking the corset she must push the kidney into its nest under the edge of the ribs—a very simple matter when once learned. The lowest hook of the corset must be fastened first, and so on from below upward. As each succeeding hook is secured the redundant abdominal wall must be drawn within the corset. Any woman a victim of nephroptosis must never be permitted to maintain the upright position without having her corset on. A corset fitted and applied in this way will maintain a replaceable kidney in a position from which it cannot be dislodged downward, and will afford relief from all symptoms depending on it.

Gallant thinks there is a certain appropriateness in curing the latest fashionable disease by the latest fashion in corsets!

There is probably a field for the "corset cure" in some cases of a slight degree of movability.

In the attacks known as Dietl's crises applications of heat externally and hypodermics of morphine with atropine may be necessary.

If the severe attacks recur surgical interference may be necessary.

**Symptomatic Treatment.**—The various phenomena of micturition, if they appear, may be treated symptomatically, as follows :

*Ignatia* : In hysterical cases. Frequent discharge of pale, watery urine of low specific gravity aggravated by drinking coffee ; lemon-yellow urine with a whitish sediment. Sensation of scraping and smarting in the neck of the bladder.

*Sulphur* : The patient urinates often with a feeling as if there were some obstruction to the flow ; sudden imperative desire to urinate or even involuntary micturition. There is constant urging to urinate both by day and by night.

*Arsenicum* : Retention of urine as if the bladder was paralyzed ; scanty urine passing with difficulty ; burning in the urethra during micturition ; tenesmus and strangury, great desire to urinate but no urine is passed ; or urine copious and burning.

*Pulsatilla* : Indicated when there is incontinence of urine, nocturnal enuresis, involuntary discharge when coughing, or discharge of urine in drops when walking or sitting ; spasmodic pain in the neck of the bladder after micturition, extending to pelvis and thighs ; burning in urethra while urinating ; haematuria ; scanty brown-red urine with brick-dust sediment.

*Strychnia* : Atony of the bladder, retention of urine or incontinence from over-distension.

*Gelsemium* : This is a useful remedy in cases where there is frequent micturition or constant dribbling of urine from weakness of the sphincter. Urination is painful and there

may be spasmodic retention from a chill or other causes.  
Spasm of the bladder with alternating dysuria and enuresis.

*Lachesis*: Pressure and pain in the bladder with urging, but inability to urinate; worse after sleep. Turning in bed may cause sensation as of a ball rolling in the bladder. There may be a sediment of uric acid or urates and severe cutting pain during micturition.

**Surgical Treatment.**—Morris sums up the question of surgical treatment as follows:

1. In movable kidney with enteroptosis no operation should be performed until it is clear that the serious symptoms are due to the kidney alone, and thorough trial of a well-fitting abdominal support and dietetic treatment has been made. Should these fail, nephropexy should be tried.
2. In cases where both kidneys are movable, they should be fixed one after the other at an interval of a week.
3. In hysterical or neurasthenic patients, operation should be tried only as a last resort.
4. In uncomplicated cases of movable or floating kidney, the operation of nephropexy may be confidently advised, without previous trial of belts or rest.
5. When renal crises are a feature, nephropexy should be strongly urged.
6. When a movable kidney gives rise to no inconvenience, an operation ought not to be thought of, and a belt need not be worn.

Senn's operation consists in slinging the kidney in a hammock of gauze for one week. The two surfaces (that of the kidney and of the fat capsule) become granulated and coalesce on removal of the gauze.

According to G. M. Edebohls, of New York, chronic appendicitis dependent upon movable right kidney may occasionally and under favorable conditions apparently end in resolution and remain permanently cured after right nephropexy. M. L. Harris's operation consists essentially in contracting the pouch in which the kidney moves.

## 2. ANOMALIES OF FORM.

These may be either congenital or acquired, usually the former. A variety most frequently encountered is the so-called "*horseshoe kidney*" (*ren unguiformis*), the two organs being united by a band of renal tissue, or of condensed fibrous tissue, passing over the vertebræ and connecting their inferior

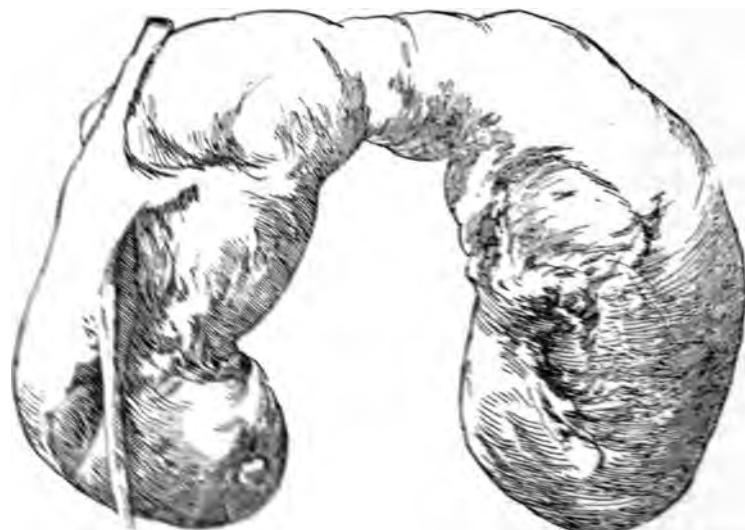


FIG. 12.—Horseshoe kidney. From MONTEZ.

extremities (Fig. 12). The concavity is usually directed upward. The two halves are usually complete in themselves, each having a distinct pelvis and ureter, and most frequently the ureters descend in front of the transverse portion. The glands are usually situated lower than normal.

A horseshoe kidney has occasionally been found in front of the great vessels.

*Lobulated Kidney* occurs in which the lobulated appearance of the fetal kidney is preserved, suggesting an arrest of development in fetal life.

In some cases the organ may be divided into two or three indistinct irregular portions by shallow depressions on its surface.

In a few cases on record one or both kidneys have had two distinct pelvis, in most instances uniting to form one single ureter, although four ureters have been found in one such case.

### 3. ANOMALIES OF SIZE.

One kidney may be large and the other proportionately small, the larger one being several times the bulk of its fellow. This condition probably arises from deficient development of one of the renal arteries.

### 4. ANOMALIES OF NUMBER.

In rare instances three kidneys have been found in one body, the third occupying a position in front of the vertebral column or at the side of the normally located glands. In one case four kidneys were found, all with their accompanying vessels and ureters.

*Solitary kidney* is a term applied to fusion of the two kidneys into one mass, which is always a congenital occurrence. Every conceivable variety of form and degree of fusion exists, from the ordinary horseshoe kidney (the lowest grade of fusion) to the completely united variety, resulting in a single disk-shaped mass with single or double pelvis. A case of S-shaped fusion of the kidneys is on record (*ren sigmoideum*) in which union took place by renal tissue between the lower end of the left kidney, in normal position, and the upper end of the right, which lay wholly to the left of the vertebral column.

Whenever the only existing kidney has two ureters and a double set of blood-vessels, it may be regarded as solitary.

*Unsymmetrical kidney* is a term applied to the case in which there is entire absence of the kidney (presumably from

atrophy), the renal vessels and ureter being likewise wanting. It may be congenital or acquired. It occurred once in 318 sections made by Morris. In man the left kidney is usually the one absent; in woman the anomaly is frequent on both sides. It is about twice as frequent in men as in women. In women congenital absence of one kidney is often shown by unilateral abnormalities in the development of the sexual system.

In cases of unilateral absence of one kidney the other is usually but not always hypertrophied, and may even attain an enormous size, weighing several pounds. It is likely to be misplaced, and to be more or less abnormal in form.

*Absence of both kidneys*, together with ureters and bladder, has been found in still-born children, especially in acephalous monsters. There is one such case on record, of a girl (who died at fourteen), in which the renal defect was associated with various defects in the genital organs. The urine, or a urine-like liquid, continually discharged from the umbilicus, which was misplaced.

#### CLINICAL NOTES.

1. Misshapen kidneys are usually misplaced.
2. When nephrectomy is contemplated the utmost care should be taken to examine the generative organs for defect, since the latter is often associated with anomalies of the kidney.
3. As long as the single kidney remains healthy there is no derangement of the urinary function; but should it become diseased, or its excretory duct obstructed, fatal uræmia rapidly supervenes.
4. Hypertrophy and atrophy of the kidneys will be considered under the heading of the various diseases where they occur.
5. The renal artery may not rarely enter the kidney at the pelvis by a number of branches either at the side or on the convexity of the organ.

## CHAPTER V.

### THE URÆMIC PHENOMENA OF RENAL DISEASES.

Uræmia is the name given to a set of symptoms formerly believed to be the direct result of accumulation of urea in the blood. We no longer believe that urea is the sole cause of the symptoms, various toxic substances being thought to play a part in the production of the phenomena, but the name is still retained.

**Pathology.**—In acute uræmic attacks increased arterial tension is regularly noticed, though not always present. The association is so frequent that it seems probable that the attacks are caused by contraction of the arteries. This belief is rendered still more probable by the fact that the symptoms usually disappear when the contraction of the arteries is stopped.

In chronic uræmia the arterial tension is not increased, but there may be an increased quantity of urea in the blood.

**Etiology.**—We find uræmia most commonly due to the following causes :

1. Nephritis, acute or chronic, more commonly in acute scarlatinal nephritis and chronic interstitial nephritis.
2. Calculus impacted in the ureter.
3. Paralysis of the bladder or over-distention of same from stupor.
4. Obstruction of the orifice of the bladder by calculi, new growths or pressure from without.
5. Strictures, laceration or compression of the urethra.
6. Phimosis.

**The Diagnosis of Uræmia.**—In general it may be said that if the urine contains albumin and casts, and the total quantity

of urea is below 200 grains (13 grams) in twenty-four hours, the patient is uræmic. For determining the quantity of urea the Doremus instrument (Fig. 13), with glass stop-cock and side arm, is most convenient.

Cases occur, however, in which the patient is unquestionably uræmic although the quantity of urea is more than 200 grains in twenty-four hours, and again, so far as the action of uræmia on the nervous system is concerned, it is sometimes very slight, even when there is much albumin in the urine with urea 150 to 200 grains per twenty-four hours.

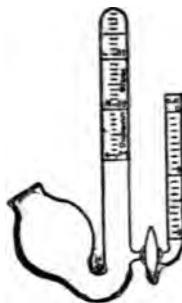


FIG. 13.—Doremus's Ureometer with side-arm for the urine.

In doubtful cases, therefore, it is advisable to test the ability of the kidney to do its work on time by means of the methylene-blue test. It must be remembered, however, in using this test that occasionally this substance is excreted in the form of a colorless chromogen.

#### DELAYED RENAL EXCRETION.

Herter's conclusions in regard to delayed renal excretion are of interest and as follows :

Delayed renal excretion may be defined as the postponement of the work of the kidney in ridding the blood of its excretory solids owing to renal disease. The postponed work consists either of the normal work of the kidney in excreting urea, salts, etc., or of unusual excretory work imposed on the

kidneys in the course of disease, or for the purpose of testing its activity. The substance most often employed in making this test is methylene blue.

Delayed excretion of urea occurs in a variety of pathologic states of the kidney, in acute and chronic nephritis, renal tuberculosis, amyloid kidney, etc. The delay is expressed in the fact that the urea formed in a given time within the body and normally excreted in a given period requires a longer time for its removal than in health. Thus kidneys which have for a considerable period averaged a daily excretion of 30 gm. of urea may suddenly take two days to do this task, while the demand on them continues as before. In such a case there would be a well-defined delay in the excretion of nitrogen. In acute diseases of the kidney the delay may be much greater than in the instance above supposed. Under such conditions the work of one day may be prolonged over 3, 4, 5 or 6 days. Similar delays frequently arise in the course of chronic nephritis. During such a delay the urea of the blood is increased. If the delay is short, the accumulation of urea in the blood is trivial; but if the delay extends over a long period, the increase in nitrogen of the blood may become distinctly pathologic. When the percentage of urea rises to about 0.3 per cent. in the blood, that is, to about ten times the normal content, the patient has either developed unmistakable symptoms of uræmia, or is in imminent danger of doing so. Herter insists on the practical value of knowing the percentage of urea in the blood of nephritic subjects. This knowledge, which can be readily obtained from an ounce of blood, is probably of more definite significance for the outlook of a patient with chronic nephritis than any information as to delayed excretion. Very often, however, there is hesitation about bleeding, and then a knowledge of whether there is delayed or normally rapid excretion may be very desirable.

In practice it is not feasible to study the excretion of urea with a view to discovering whether it is delayed. This is

owing to technical difficulties which need only be referred to here. In place of a study of the nitrogenous excretion, the kidney may be interrogated by means of the methylene-blue or potassium-iodid test. When methylene-blue is introduced into the body of a normal person by injection into a muscle (*e.g.*, the *vastus internus*), it appears in the urine after a few minutes (10 to 30). If the dose be moderate, say, one grain in ten minimis of water, the dye continues to color the urine for a period lasting from 15 to 48 hours in different persons. In most normal individuals the coloration disappears in the course of 36 hours.

When methylene-blue (in the dose mentioned) is injected into the muscle of a patient suffering from nephritis the color appears in the urine, usually as promptly as in health, sometimes after a delay of a few hours. The time required for the *disappearance* of the blue color varies much in different cases of nephritis. In many instances of unquestionable renal disease associated with albumin and casts in the urine, the dye disappears in the course of 36 to 48 hours, as in persons with normal kidneys. In other patients there is a distinct delay in the disappearance of the methylene-blue from the urine. Instead of quitting the urine in less than three days the coloration persists 4, 5, 6, or even 7 days and longer. It is this delay in the *disappearance* of the dye from the urine that is of interest to the practitioner. As already mentioned, there is sometimes a delay in the appearance of the blue-green color. Some writers have attached importance to this, but we do not know enough about the sign to use it in diagnosis. It is certainly true that there are cases of chronic nephritis in which there is delay in the disappearance of the blue-green color without any delay in its appearance.

Certain conclusions with reference to the methylene-blue test seem warranted. 1. A distinct delay in excretion is evidence of the inability of the kidney to do its normal excretory work on time, owing to structural alterations, or per-

haps temporary disturbances in renal innervation. 2. Such a delay, when prolonged (four days or more) and repeated, is probably associated with an increase in the urea of the blood, and, like such an increase, is to be taken as a sign of latent uræmia, even though definite uræmic symptoms be absent. 3. Periods of delayed excretion may alternate with periods in which there is no delay. 4. The prompt disappearance of the dye, *i. e.*, within thirty-six hours, may probably be taken as an indication that the kidneys are normally ridding the blood of urea, salts and other urinary constituents, even though the urine contains albumin and casts.

The use of injections of methylene-blue as a diagnostic measure in renal disease is not entirely free from danger in some cases in which the kidney is the seat of advanced lesions. In acute nephritis with partial suppression, and in chronic nephritis with impending uræmia, it may do harm by imposing additional work on organs already over-burdened. Well-defined, unmistakable uræmic symptoms forbid the use of the injections. In a very great majority of cases of chronic nephritis there is no objection to their use. When it seems undesirable to administer the methylene-blue by injection, it can be given by mouth. There appears to be no danger from the internal administration of one grain of the dye, except possibly in some outspoken acute uræmias. Normally the blue is eliminated more rapidly when given by mouth than when injected, the usual period being from eighteen to forty hours. The rapidity of absorption influences the time at which the dye appears in the urine and possibly also affects somewhat the time of disappearance. The method is therefore less reliable than the method by injection. Nevertheless it is useful, and a delay of three, four or five days in the elimination of the dose is to be interpreted in the same way as if it had been injected.

In view of the fact that methylene-blue is sometimes excreted as a colorless chromogen, the writer's study of this chromogen will be of help in doubtful cases.

## COLORLESS CHROMOGEN OF METHYLENE-BLUE IN URINE.

Urine on exposure to air turns greenish.

Heated with addition of acetic acid, a persistent bright blue-green.

Titrated with uranium nitrate, etc., a bright blue-green supernatant liquid.

Silver nitrate solution (1 in 8) gives curdy-white precipitate, immediately blackening at the bottom with light blue-green supernatant.

Barium chlorid : white precipitate, faint blue-green supernatant.

Ferric chlorid solution (20 per cent.) : olive green color below the phosphates.

The green colors can be obtained when the urine is several days old.

## OTHER TESTS FOR URÆMIA.

In addition to the methylene-blue test the activity of the kidneys may be tested by potassium iodid and phloridzin. Cryoscopy is also useful in cases when a quantitative analysis of the urine is not convenient.

Potassium iodid can be given by mouth for the purpose of testing the activity of the kidneys. In normal adults under fifty, a dose of 10 grains is followed by the presence of the salt in the urine for a period varying from 24 to 36 hours. A delay of more than 40 hours probably indicates some degree of renal inadequacy. Further studies of the behavior of pathologic kidneys towards this salt are needed.

**Phloridzin Diabetes.**—The hypodermic injection of 0.005 grain of phloridzin is followed by a glycosuria, which, normally, begins in half an hour, lasts from two to four hours, and in quantity amounts to from 1 to 2 grams. In renal diseases the appearance of the glycosuria is delayed and the amount of sugar less.

**Cryoscopy.**—The determination of the freezing point of urine by a special apparatus, as Beckmann's, serves to show whether the solids in the urine are diminished or not. Normal urine freezes from 1.3 to 2.3° C. lower than distilled water. In nephritis and other morbid states of the kidney the urine freezes with less diminution of temperature, that is, the freezing point approaches more nearly that of water.

**Clinical Diagnosis.**—For clinical purposes the writer assumes that cases in which loss of muscular strength is noticed, together with the presence of casts in the urine, and even but a trace of albumin, sought for not only in the night urine but in the day, and even if found only in the day, are cases of uræmia, especially if the quantity of urea is below 200 grains and regardless of whether it is above 200 grains *per diem* or not.

**Symptoms of Acute Uræmia.**—The prominent symptoms of acute uræmia are the following: *Intense frontal headache*, puffiness of the face, drowsiness or sleeplessness, ringing in the ears or light before the eyes, dimness of vision, possibly sudden blindness of one or both eyes, *dizziness*, difficulty of breathing, especially on exertion; nausea, *vomiting*, involuntary twitchings, especially of the face and hands; general prostration, delirium, hemiplegia, and *voiding of urine*, which, as a rule, is scanty and contains albumin; *convulsions and coma* may then ensue. In some cases, even after convulsions have begun, an abundance of urine may be passed; but it is pale, watery, and contains much albumin.

In acute uræmia the severest nervous symptoms appear suddenly, last a comparatively short time and may terminate fatally with convulsions, coma, dyspnoea, feeble heart action, fever, and pulmonary oedema. Acute uræmia seldom lasts more than a few days.

**Uræmic Convulsions and Coma in Acute Uræmia.**—The characteristic features of uræmic convulsions are that they are equal on both sides of the body. The person is not paralyzed

on one side of the body ; he is not completely unconscious ; his pupils tend to dilate ; his appearance is pallid ; his temperature may be increased from the beginning of the convulsions and range from  $100^{\circ}$  to  $102^{\circ}$ , but more frequently the temperature is subnormal, the pulse is increased, ninety to one hundred and twenty beats per minute ; respirations may or may not be hastened ; the breathing is of a peculiar, hissing character, the noise in breathing being made by the lips ; the breath has a peculiar urinous odor. The convulsions are likely to recur. They may be preceded by pain and restlessness or come on suddenly.

Uræmic convulsions are clonic rarely tonic. They vary from twitchings to general clonic convulsions with loss of consciousness, the so-called *uræmic eclampsia*.

Unconsciousness invariably accompanies general convulsions, but *coma* may develop independently. It is frequently preceded by headache. The patient may be dull and apathetic before coma.

Coma may develop without any symptoms of renal disease other than the urinary findings.

The patient may be in a condition of torpor for weeks or months at a time, his tongue furred and his breath foul and heavy.

**Differential Diagnosis.**—Uræmic convulsions or coma must be distinguished from apoplexy, epilepsy, hysteria, meningitis, typhoid fever, miliary tuberculosis, alcoholic poisoning and opium poisoning.

In apoplexy there is complete paralysis of one side of the body following convulsions limited to one side of the body. The apoplectic patient almost always turns his head with convulsive twitchings to the paralyzed side, and in many cases there is very high temperature,  $104^{\circ}$  to  $105^{\circ}$ , and if the latter, death will take place in a few hours. Conjugate deviation of the eyes occurs.

A suffused face, stertorous breathing, eyes turned toward

the side of hemorrhage, full, slow pulse and hemiplegia should suggest apoplexy. (Butler.)

It is difficult always to distinguish uræmic convulsions from epileptic attacks, since patients in the former often injure their tongue and simulate very closely an epileptic seizure. But if there is history of previous epileptic attacks, and if the attack is preceded by a cry, epilepsy is the trouble. Moreover, uræmic convulsions are attended by greater pallor and are more marked than epileptic ones, being equal on both sides, while in epilepsy they are more marked on one side. Local or Jacksonian epilepsy may occur in uræmia.

Hysterical spasms resemble uræmic convulsions somewhat, but the pupils, face and temperature are normal, and the patient is conscious. A choking sensation is often observed in hysteria which is absent in uræmia.

Meningitis with deep coma and slight fever may readily be confused with uræmia, but may be distinguished by the mode of onset, the rigid neck, the incoherent speech or mild delirium, the photophobia and pronounced fever.

Diabetic coma is distinguished by the presence of the red reaction in the urine with ferric chloride solution.

Typhoid fever or miliary tuberculosis is sometimes thought to be present when uræmia is the real condition. The Widal reaction should be sought for in doubtful cases.

In alcoholic poisoning the coma is not usually so profound as in uræmia and the odor of the breath may serve to differentiate.

The comatose stage of uræmia sometimes closely resembles opium coma. The contracted pupils, opium breath, slow breathing, purplish hue and ghastly expression of the opium victim will sometimes distinguish him from the uræmic sufferer.

**Symptoms of Chronic Uræmia.**—Chronic uræmia affects essentially the following :

1. The brain and nervous system.

2. The skin.
3. The breathing apparatus.
4. The heart and arteries.
5. The stomach and bowels.
6. The kidneys.

Among symptoms of prime importance is *headache*. It may be anywhere in the head or localized in the forehead, vertex, or occiput. Unilateral headache occurs, known as *uræmic hemicrania*.

Occipital headache is common and extends down into the nape of the neck.

The headache may be accompanied by giddiness.

In acute uræmia constant, severe frontal headache is noticed.

*Neuralgia* is of common occurrence ; it is usually supra-orbital and occipital. It is quite frequently persistent. Vertigo, with sense of weight and pressure in the head, occurs in some cases.

Mental disturbances, melancholia, and even insanity, have been known to be due to uræmic poisoning. Whenever these come on suddenly the urine should not be forgotten. Other cerebral manifestations of uræmia are drowsiness, stupor or delirium, convulsions, and coma.

Insomnia, mental depression and loss of memory occur. The most amiable and sanguine dispositions may become morbidly depressed. The person is peevish, suspicious, impatient, or he may feel dull or stupid, with attacks of drowsiness.

Insanity, due to Bright's disease, is of two forms, according to whether the person has insane heredity or tendency or not. If he has no such tendency, he suffers merely from a mild, quiet mania like dementia. If albumin disappears from the urine and he improves in general respects, his mania improves and he may get entirely well.

On the other hand, in those predisposed to insanity the kidney disease acts as an exciting cause ; serious outbursts may

be expected, and there is need of restraint in some institution, as suicidal tendencies may develop.

Delirium may occur, but is a rare symptom. It is usually preceded by headache, eye troubles, and mental confusion. It is usually of a quiet type, but violent mania with a high temperature ( $107^{\circ}$ ) has been known to follow uræmic convulsions. The delirium may be chronic, with hallucinations of sight, delusions of persecution, convulsions, and vomiting. A case is on record where the patient was furiously delirious for several months, and died from collapse.

The delirium of uræmia may show itself in the following manner: The person becomes restless and uneasy, the eyes vacant, staring or wild, hallucinations are present, and memory is for the time more or less completely lost. The person is, however, more or less rational, and can converse for a short time, or answer a few questions, but will repeatedly ask questions to which he has just received a reply, and when the attack passes off cannot recall anything which has happened. Severe headache may accompany these attacks, and the person is restless at night, tossing about and talking incessantly.

Peculiar attacks of numbness and tingling may occur in the course of chronic uræmia, limited sometimes to the face, but possibly including all of one side of the body. In the latter case the numbness begins in one foot, usually the left, and extends up the side until the left side of the head, including the tongue, becomes affected. Motion is not impeded. The attack lasts from fifteen minutes to half an hour, when it disappears, leaving no disturbance behind. Numbness and tingling in the fingers is sometimes noticed.

## URÆMIC PARALYSIS.

*Uræmic paralysis* may occur either as hemiplegia or monoplegia without cerebral lesions.

This, in two-thirds of the cases as shown by Baillet, does

not set in all of a sudden ; it is accompanied by convulsions or begins with coma. Clinically we find two classes of cases, those of chronic and those of subacute nephritis. In chronic nephritis after a few insignificant prodromata there is a sudden loss of consciousness preceding or accompanying hemiplegia. The case may closely resemble one of central cerebral haemorrhage. In subacute nephritis the paralysis may occur in the case of children affected with scarlet fever and in pregnant women.

Hemiplegia of uræmic origin is often partial and assumes the bronchio-crural type in one-half the cases. In the others it is accompanied by a facial paralysis.

**Intensity of Uræmic Paralysis.**—This is usually greatest at the moment of its appearance or on the following day. Incomplete paralysis is more frequent in chronic nephritis ; complete is invariable in subacute.

The paralyses, as a rule, are *flaccid*. Contractions, however, have been observed by Baillet in severe cases, always early in the course of the case.

**Variability.**—Uræmic hemiplegia may persist without notable modification until death ends the scene, or it may gradually decrease little by little, to disappear almost suddenly and to reappear. Its duration varies between a few hours to five days. Death generally ends the matter.

**Phenomena Accompanying the Uræmic Paralyses.**—Disturbances of sensibility have been noticed in all uræmic states. Though sometimes unaffected, in the majority of cases it is diminished or abolished. It should not be forgotten that it is not the grade of the paralysis that regulates the sensibility, but the state of the intelligence.

**Reflexes.**—The patellar reflex is usually abolished or decreased on the paralyzed side, yet it may be normal or exaggerated. As to the pupils, they are generally contracted.

Conjugate deviation was noted by Baillet in a dozen cases as associated with the hemiplegia. Ordinarily on the opposite

side to that paralyzed; it may be on the other. In three cases of this kind it was ascribed to contracture of the muscles of the neck of the paralyzed side.

**Thermic Curve.**—Most often there is no modification of the temperature. In five cases only the elevation noticed appeared to be due to uræmic poisoning. In the others it was apparently a pulmonary complication to the convulsions, etc. On the contrary, a lowering of the temperature has never been detected.

**Uræmic Aphasia.**—The uræmic aphasia usually is noted as a pure motor aphasia, but it is probable that agraphia, together with blindness, often complicates motor aphasia and word deafness. Uræmic aphasia is generally preceded by serious manifestations of urinary poisoning. It is most frequently associated with hemiplegia, which is either total or partial and generally right-sided. The aphasia may supervene independently of any motor disorder of the limbs or face. Three cases of sensorial aphasia without associated motor aphasia are reported.

**Prognosis.**—From a study of the case it seems that the appearance of a uræmic paralysis is of grave prognostic importance. Death follows in three-fifths of the cases in a period varying from a few hours to a few days.

**Diagnosis.**—The diagnosis of uræmic paralysis is of extreme difficulty, especially of those cases occurring during the course of chronic nephritis.

**Treatment.**—Treatment is that of the uræmia in general. An abundant venesection appears to be indicated above all things, before the administration of diuretics and before commencing with the milk diet. (Baillet).

#### OTHER CLINICAL FEATURES OF URÆMIA.

*Aphasia* is noticed in some uræmic cases and at times may be the sole expression of the state. Riesman offers the following conclusions regarding it:

It is frequently associated with right-sided motor-paralysis, hemiplegic or monoplegic in character.

It may be the precursor of uræmic convulsions or coma.

The aphasia is usually of the motor type, but may be sensory. There may be word-blindness and word-deafness.

It may be associated with agraphia, even when there is no paralysis of the limbs.

It is comparatively frequent in children, particularly in cases of post-scarlatinal nephritis. In adults it may occur in any form of Bright's disease.

It is generally transient, disappearing completely. In time it is intermittent, and has a marked tendency to recur.

When paralysis is present, the two may disappear simultaneously, usually the aphasia first.

The features of uræmic aphasia are, *per se*, not characteristic of the causal condition.

The most important diagnostic features are the transitoriness of the aphasia and the presence of other uræmic symptoms and of signs of nephritis.

In every case of sudden aphasia the possibility of its being renal in origin should be considered, and careful studies of the urine and of the system at large should be made with this thought in mind. (*American Medicine*, June 21, 1902.)

Among minor nervous phenomena have been noticed cramps, severe tremors resembling shaking palsy, and spasm of the flexor of the forearm and posterior muscles of the neck.

There may be poisoning of the centres of sight and hearing. Sometimes the person notices that he has dimness of vision, perhaps only in one eye, and that when he tries to read the letters blur. This is more common in the more insidious form of Bright's, without dropsy and with little albumin, than in other forms. Again, cases occur in which the person is stricken blind without warning, and not until this has happened has any one thought it worth while to examine the urine. Sudden blindness is occasionally the

first symptom of uræmia which may be noticed. In other cases the failure of vision may be gradual, or the blindness, if occurring, be confined to one eye. Fortunately, uræmic blindness, though terrifying, is transient in character. It is called uræmic amaurosis and usually follows convulsions. It lasts only a day or two.

Among other disturbances of vision, photopsia, or seeing flashes of light, may be observed.

*The pupils* of the eyes may be small and react sluggishly to light. This condition is known as *uræmic myosis*.

*Blindness* of one-half the visual field may occur. The patient may see double, objects may be inverted, or there may be more or less indistinctness of vision.

After convulsions *amaurosis* exists for a day or two. It rarely precedes convulsions or appears without them. It develops quite rapidly and blindness is soon present. The pupils, however, usually react to light, and the retinal image is normal when seen by use of the ophthalmoscope. The location of the lesion is not known; it may be due to disturbance in the occipital cortex.

*The ears* are affected in uræmia. Sometimes there is an annoying ringing, in other cases there may be failure of hearing. Deafness may follow convulsions or may accompany headache, nausea or other gastric symptoms.

*The mouth* may exhibit a peculiar inflammation, uræmic stomatitis with furred tongue, foul breath, oedema, hyperæmia and swelling of the lips and buccal mucosa.

*The face* in uræmia is pallid, the *features* more or less distorted, the *eyes* staring, the *breath* urinous. The skin in some cases may be covered with a whitish deposit of urea crystals, the so-called *uridrosis*.

*The bodily temperature* is usually subnormal, but elevation of temperature may occur. (1) When there is an inflammatory process; (2) during convulsions; (3) from unknown cause.

After convulsions the temperature may fall rapidly. Uræmic *chills* sometimes occur. They come on suddenly with other uræmic symptoms, and with great increase in temperature followed by a rapid fall of the same.

The *skin* is affected in various ways, paræsthesia, intense itching, burning, erythema, eczema and gangrene have been noticed. The patient sometimes has an ammoniacal odor of the body.

Dropsy, if it has been present, may in some cases be markedly reduced before the onset of uræmic symptoms.

The *subcutaneous tissues* are affected as shown by the occurrence of *dropsy*.

Œdema may affect the glottis, causing death from suffocation in a short time.

Uræmia may affect the serous membranes, causing pleurisy or pericarditis, less commonly peritonitis or meningitis.

Pneumonia sometimes appears suddenly in the course of uræmia.

Hydrothorax is quite common in uræmic cases.

Obstinate cough and hoarseness from œdema of the larynx may occur.

The action of the *heart and arteries* is to cause high arterial tension, cardiac hypertrophy, haemorrhages and anæmia.

The action of uræmia on the blood-vessels is to impair the nutrition of their walls, so that they are either unduly permeable or become ruptured. This is shown by epistaxis, the vomiting of blood, retinal haemorrhages, purpura and bleeding of the gums.

The condition of the *pulse* in uræmia is an important feature. At times an unusual slowness of it is a forerunner of an attack of uræmia. In cases of cardiac failure there is a small pulse deficient in tension.

Uræmic *dyspnœa* may be continuous, paroxysmal, alternately continuous and paroxysmal, or there may be breathing of the Cheyne-Stokes variety. It may persist for weeks or

months and yet be followed by recovery. Uræmic cardiac asthma occurs in some cases.

The *gastro-intestinal symptoms* may appear suddenly. The patient may be seized with uncontrollable vomiting; sometimes the vomiting is preceded by nausea and associated with diarrhoea, or there may be diarrhoea without vomiting, sometimes profuse and associated with intense catarrhal or diphtheritic inflammation of the colon.

In some cases *constipation* is a feature. Loss of appetite and morning nausea are also noticed.

The *action on the muscular system* is shown by loss of strength. In the writer's experience this is a classical symptom of chronic uræmia, occurring when no other symptoms appear.

Finally, death attributed to shock, or septicæmia after surgical operations, may perhaps be really due to acute uræmia. Many surgeons now insist on quantitative analysis of the urine before a serious operation is to be performed. Careful men will usually not operate when the amount of urea per diem is below 12 grammes (185 grains).

**Duration.**—In acute cases sudden death may take place; subacute cases may last for eight weeks or more; chronic cases for months or years with periods of marked remission of symptoms.

**Causes of Death.**—Death may be due to (1) Convulsions with cerebral or neural paralysis; or, (2) œdema of the glottis or lungs; (3) some serous inflammation; (4) pneumonia.

**Post-Mortem Appearances.**—Intestinal ulcers, the so-called uræmic intestinal ulcers, are sometimes found post-mortem. They may be due to irritation of the mucous membrane from ammonium carbonate.

**Prognosis.**—This depends upon the cause. If the case is one of acute nephritis the prognosis, though always serious, is not hopeless. (See ACUTE NEPHRITIS.)

If the case is one of chronic interstitial nephritis theulti-

mate prognosis is unfavorable, but remissions may occur of months or years.

If the case is due to a cause surgically remediable, as stricture or phimosis, the prognosis is more favorable.

**Symptomatic Treatment.**—In acute uræmia the remedies given symptomatically are Apis, Belladonna, Conium, Glonoin, Gelsemium, Stramonium, Veratrum viride, Agaricus, Anacardium, Hydrocyanic acid, Lactuca and Opium. In chronic uræmia Arsenicum, Aurum, Cuprum, Hydrocyanic acid, Nicotin, Phosphorus and Terebinth.

In addition to the above Ammonium carb., Carbolic acid, Cannabis Indica, Cantharides, Cicuta, Arsenite of Copper and Helleborus have been advised by various physicians.

The indications for the use of these remedies will be found under the heading of the treatment of the various disorders in which uræmia occurs.

**Palliative Treatment.**—If the patient is in a stupor with a distended bladder the urine is to be drawn with a carefully sterilized catheter. If there is phimosis, this is to be attended to.

In other cases eliminative treatment by diuresis, diaphoresis and catharsis is to be pursued. (See ACUTE AND CHRONIC NEPHRITIS.)

Eichhorst gives a formula for removing the foul odor of the breath as follows: Benzoic acid, four and a half grains; camphor, three-quarters of a grain; sugar, seven and a half grains. Make into ten powders and give one every two hours.

For the unpleasant itching of the skin tepid baths and inunctions of carbolated ointment may be tried.

In general, diaphoresis and catharsis is the treatment; if these are insufficient or the case is grave, venesection with counter-injection into the veins of normal salt solution should be tried, especially when there are convulsions or coma.

The subcutaneous injection of sterilized serum is said to be a successful measure.

## CHAPTER VI.

### DISTURBANCES OF THE CIRCULATION OF THE KIDNEYS.

The amount of blood in the kidney is subject to marked variations. The circulation is under the influence of the vaso-motor system, but the nerves accompanying the renal vessels are small. They are derived from the renal plexus and particularly from the lesser splanchnic nerves. The blood-vessels of the kidney are plentiful, and their distribution such that the medullary blood supply is to a considerable extent independent of the cortical, hence disturbances in the one do not necessarily affect the other.

The disturbances which will be considered in this chapter are, I. Thrombosis. II. Embolism. III. Anæmia. IV. Hyperæmia, active and passive.

#### RENAL THROMBOSIS.

Thrombosis of the renal vein is a cause of passive hyperæmia, which see.

Thrombosis of the renal vein in infants may result from traumatism during delivery or from septic infection. In anæmic or cachectic infants *marantic thrombosis*, so-called, may occur.

Thrombosis of the renal artery is rare, and more frequently affects the left than the right on account of its longer course across the aorta. The causes are inflammatory and degenerative changes in the arterial walls and surgical ligation. In aneurism of the abdominal aorta the blood clot may sometimes extend into the renal artery. The kidney is swollen and oedematous, and often presents numerous haemorrhages, which occasionally are extensive.

## RENAL EMBOLUS.

**Synonym.**—Infarction of the kidneys.

**Definition.**—Renal embolism consists of an impacted, non-irritating thrombus, formed somewhere in the circulatory system and carried to the kidney, where it blocks a terminal renal vessel.

Fat emboli in connection with those in the lungs, and in fractures, pyæmia and surgical operations occur. Pyæmic emboli are also known.

**Etiology.**—Endocarditis, especially left; valvular diseases of the heart; parietal thrombi in aorta. Emboli come from the cardiac valves, in form of detached fibrin or atheromatous material, or from arterial thrombi, aneurisms, or atheromatous patches. Infectious results occur when emboli contain bacteria.

**Pathologic Anatomy.**—Most commonly emboli reach the kidney through the left renal artery for anatomical reasons, but they rarely lodge in the artery; in case of lodgment necrosis of the whole kidney, except small subcapsular areas, takes place; as a rule, the emboli are swept into smaller branches and we find an ischemic wedge-shaped area of necrosis in the region supplied by the obstructed vessels, of opaque gray-white or red-gray color surrounded by a dark red zone. The dead portion is eventually absorbed and replaced by a scar adherent to the renal capsule, often containing blood pigment. If pyogenic bacteria in embolus, then abscess.

Microscopically: Area of necrosis of tubular epithelia. Fat-drops eventually appear. Interstitial inflammation near infarct (embolic contraction) in certain cases.

In case there are several emboli in the renal vessels then we may find a multinodular irregular surface and an atrophic appearance of the organ.

**Clinical Features.**—Previous history of endocarditis. Sud-

*den* pain in the back, with vomiting and chills, especially if heart is weak. Sense of praecordial oppression or clogging, and frequently dyspncea. Slight temperature. Some little collapse.

**The Urine.**—Abrupt change in the urine; decreased quantity, increased color, specific gravity and acidity. Sudden appearance of albumin, blood and casts. In from two to five days gradual improvement, until urine is normal again, in three or four weeks at most.

**Prognosis.**—Favorable.

**Treatment.**—Absolute rest in bed at uniform temperature. Warm clothing. Careful nursing. Milk diet. In case of feeble persons eggs and limited amount of small farinaceous or cereal foods.

If the pain is severe an ice-bag may be applied to the loin or morphine given in small doses subcutaneously.

#### RENAL ANEURISM.

The symptoms are tumor, loss of appetite, dyspeptic symptoms and wasting, with occasional attacks of pain. The tumor is smooth, elastic, with expansile pulsation, and may be about the size of a foetal head, beneath left costal arch, extending from ribs to a hand's breadth below navel, apparently fixed in renal region. Diagnosis is difficult. If such a tumor develops rapidly after an injury or severe exertion in a patient with arterio-sclerosis, but without marked cachexia, it should suggest renal aneurism.

In some cases the patient dies suddenly from internal haemorrhage before the condition is suspected.

The treatment, if the condition is discovered, is solely operative, removal of the organ by nephrectomy as described by W. W. Keen, of Philadelphia.

#### ANÆMIA OF THE KIDNEYS.

**Etiology.**—The principal causes are as follows: General

anæmia from hæmorrhage, pernicious anæmia or other causes; obstruction of the renal artery as by embolism or through pressure from tumors or fibrous bands; thrombosis of the renal artery from disease of the intima; spasmodic contraction of the renal arteries through stimulation direct or reflex of the vaso-constrictor nerves, as in hysteria, after catheterism or other forms of irritation of the urinary tract, and also in strychnine poisoning, epilepsy, lead colic and puerperal eclampsia.

**Pathology.**—According to the duration of the anæmia and the suddenness of onset the changes in the kidneys are found to vary. In cases of short duration the kidney is somewhat paler, smaller and harder than normal. In chronic anæmia, fatty degeneration of the epithelium is common. Complete necrosis follows total obstruction of the renal artery or its branches; partial obstruction leads to various degenerative changes of milder degree.

**Clinical Features.**—Inasmuch as the quantity of urine depends upon the blood pressure in the kidney the principal feature in anæmia is *oliguria* or *anuria*. In hysteria the scanty secretion of urine may be present for days without giving rise to serious disturbances; the anuria that sometimes follows the passage of the sound or catheter may cause death from uræmia in a few days; so also in puerperal eclampsia. Albumin is found in the urine in many cases of anæmia, due probably to degenerative changes in the glomeruli. In a case of pernicious anæmia the writer found excess of urobilin, a high ratio of urea to phosphoric acid, and a low ratio of urea to uric acid, with deficiency of both urea and phosphoric acid and a normal excretion in twenty-four hours of uric acid. There was a trace of albumin, and in the sediment hyaline, epithelial and granular casts were found.

**Differential Diagnosis.**—Anæmia of the kidneys must be differentiated from hyperæmia of these organs. The history of the case, the cause and the fact that the urine if not sup-

pressed, although containing a trace of albumin and various casts, is of high color but not high specific gravity with deficiency of urea and phosphoric acid will differentiate from hyperæmia.

Anæmia of the kidneys must be differentiated from nephritis, especially from chronic interstitial nephritis (chronic diffuse nephritis with induration). The differentiation is to be made largely by a thorough clinical examination of the patient with a study of the history and causes. If the urine is of high color but low specific gravity as in pernicious anæmia, this should suggest at once an examination of the blood. From other forms of chronic nephritis the small amount of albumin and the absence of fatty or waxy casts will aid in the differentiation.

**Treatment.**—The treatment of anæmia of the kidneys resolves itself into that of the varied conditions to which the anæmia is due.

#### ACTIVE HYPERÆMIA.

**Synonyms.**—Acute hyperæmia, acute or active congestion.

**Definition.**—Abnormal influx of arterial blood into the kidneys.

**Etiology.**—1. Acute hyperæmia may occur, temporarily, after exposure to cold or excessive ingestion of fluids; it may result from nervous polyuria or occur in diabetes mellitus or insipidus.

2. It is frequently found after extirpation of one of the kidneys or following surgical operations on the urinary tract.

3. It may result from long-continued lithæmia or oxaluria.

4. It is caused sometimes by the blood poisoning of certain diseases, as malaria, the eruptive fevers and inflammatory diseases, by poisoning with cantharides, turpentine, ether, chloroform.

5. Protracted, active hyperæmia is likely to result in acute

nephritis, which see. This condition always precedes acute inflammations of the kidneys.

6. It sometimes depends on hypertrophy of the heart, and occurs in exophthalmic goitre.

7. Temporary congestion of the kidney, according to Bequet, takes places at every menstrual period.

8. In general in conditions of heightened arterial pressure, excessive or unusual exertion, as in athletic games or mental excitement.

**Pathology.**—Active hyperæmia depends, as a rule, on paralysis of the vaso-constrictor nerves of the renal arteries; perhaps also upon stimulation of the vaso-dilators.

**Pathologic Anatomy.**—*Kidneys.*—Macroscopically, we find them normal or slightly enlarged. Moist, firm.

*Capsule.*—Normal. Strips easily.

*Renal Surface.*—Smooth, dark red in color.

*Cut Surface.*—Dark. Cortex a little darker than pyramids.

*Renal Substance.*—Soft, vessels engorged with blood.

*Malpighian Tufts.*—Congested, appear as dark red points in cortex.

*Epithelia.*—Deeper in color than normal.

*Blood-vessels.*—Microscopically we find them distended with blood.

*Location of Congestion.*—Principally on arterial side and in capillary loops of glomerulus. In other words, the morbid process lies mainly in the renal arteries and the arteries of the Malpighian tufts.

**Clinical Features.**—Aching in the loins as along course of ureters or radiating to hips. More or less prostration. Tenderness over renal region on deep pressure. Nausea, vomiting, perhaps headache. If due to fevers, symptoms of pyrexia.

If due to poisons, as cantharides, turpentine, then frequency of micturition, together with, perhaps, pain, urgency, or vesical tenesmus.

If due to over-exertion the only signs may be the changes

in the urine. Acute congestion of the kidneys may be a very alarming and often a very sudden malady. The fibrous capsule of the kidney being unyielding, there is not only blood stasis but pressure and arrest of function, partial or complete, which is soon followed by very grave symptoms. Dropsy may or may not be present, but nearly always there is headache, dyspncea, scanty urine, deep-seated pain in the back over the kidneys, and certain nervous symptoms which may develop into delirium, coma and convulsions.

Convulsions may occur even if albumin is absent from the urine, due, it is claimed by Rachford, to xanthin and para-xanthin increased in the blood and found also in the urine. In severe cases after nephrectomy the patient may pass into a typhoid condition with delirium. After injury collapse may supervene with suppression.

**The Urine.**--*Blood* the feature, the quantity of it ranging from a few scattering corpuscles, in mild cases, to very bloody urine in severe.

*Albumin*.—*Small or none.* Rarely above 10 per cent. bulk.

*Casts*.—*Few, small, hyaline or none.*

*Epithelium*.—Free renal, often ; not always found.

*Quantity of Urine per Twenty-four Hours*.—First, slight polyuria; later, volume deficient. Color and specific gravity increased. Complete suppression may occur.

*Solids, Grains per Ounce*.—First, diminished; later, increased.

#### CLINICAL NOTES ON THE URINE.

1. In cantharides poisoning, clots of fibrin may appear in the urine.
2. Congestion with suppression may occur without either blood or albumin in the urine ; as congestion subsides the first urine voided will be heavily loaded with urates ; albumin and casts absent.
3. A sediment of urates is common in this disorder.

4. In some cases the quantity of urine is much below normal, but albumin is absent. In such Rachford has found xanthin and paraxanthin in the urine.

5. After foot-ball games the urine of players may contain albumin and casts : blood, epithelial and granular.

**Differential Diagnosis.**—From acute nephritis by absence of dropsy or anasarca. From passive congestion by absence of cardiac lesions, and absence of passive congestion of the liver.

From anaemia of the kidneys by the history and causes, and usual presence of blood in the urine in greater or less amount, and by the usual relative increase of solid matters (grains per fluidounce) even if the total amount is small.

**Prognosis.**—Almost always favorable but depends on cause ; if this is functional, disorder is transitory. In malarial poisoning, or that by irritating diuretics, suppression, uræmia, and death may occur. If the patient was previously nephritic prognosis unfavorable. The hyperæmia which occurs after surgical operations may prove fatal if continuing more than two days.

A single attack is not in itself dangerous, but repeated attacks are conducive to nephritis. Where serious complications do not occur the prognosis is good. The dangers are suppression of urine, convulsions and coma.

**Treatment.**—In urgent cases when the urine is very scanty or suppressed the patient is to be put to bed and kept on thin rice gruel for food. He should be given large quantities of hot water to drink ; hot foot baths should be given him and hot applications to the region of the kidneys should be made. Rectal injections of warm normal salt solution should be frequently made. Lithia tablets (five grains) should be dissolved in the hot water taken by the patient four to six times daily.

In cases in which the congestion is not of many hours standing dry cupping and sweating with hot drinks as lemonade or flaxseed tea will often restore the function of the kidneys.

In plethoric cases when all measures fail to relieve the convulsions venesection may be tried or veratrum viride hypodermically. In some cases the treatment is that of the fever or inflammatory disease on which the congestion depends; or the removal of the poison or irritant, if the disorder is caused by such.

**Symptomatic Treatment.**—*Terebinthina*: Useful in acute congestion of the kidneys when there is scanty, dark colored urine containing blood and albumin. To be used in small doses not to exceed one drop. Stimulating diuretics (in material doses) like Juniper, Turpentine and Squill must be avoided in acute hyperæmia.

*Lithia*: The soluble compounds of Lithium are serviceable in the milder cases where there is severe pain in the back, but as yet the urine is not suppressed and contains but little or no albumin. There is scanty high-colored urine with an abundant sediment of urates and a few blood corpuscles, microscopically. The writer has speedily relieved a number of mild cases of this sort occurring in the course of la grippe by hot applications to the kidneys and lithium citrate internally in five-grain doses four times daily, in water.

*Eucalyptus*: This remedy in doses not to exceed one drop of the oil every two or three hours may help restore the function of the kidneys when given after cupping.

*Glonoin*: In cases of chronic nephritis subject to acute hyperæmic attacks this remedy may be used in doses of  $\frac{2}{5}$  of a grain every two hours until the patient passes urine more freely.

*Chloride of Gold and Sodium*: Given under about the same conditions as Glonoin, according, however, to symptoms present, especially the mental ones, and the voiding of more urine at night than during the day. May be given as low as  $\frac{1}{6}$  of a grain, four times daily.

*Aconite*: Useful in cases where the congestion is due to over-exertion or exposure to cold.

*Arnica*: In cases due to over-exertion and injury.

*Dulcamara*: In cases due to exposure to cold.

*Mercurius cor.*: When there are gastric and hepatic symptoms, pain in the back, frequent micturition.

*Veratrum viride*: In cases due to surgical operations, trauma or shock.

*Camphor*: In cases due to poisoning by *Cantharides*.

Other remedies sometimes indicated are *Belladonna*, *Cantharides* and *Sandal-wood*.

The writer uses *Terebinth* and *Glonoin* most, occasionally *Aconite*.

**Surgical Treatment.**—For the relief of tension in a severe case of acute renal hyperæmia Adams split the kidney in two, making the incision along the convex border of the organ. The operation resulted in recovery. The symptoms suggested stone in the kidney.

#### ANURIA AFTER THE USE OF ANESTHETICS.

Whether the anuria following the use of anesthetics is due to acute hyperæmia or not, it is convenient to consider it here.

**Etiology.**—Saturation with ether causing a depression of the circulatory system and interference with the flow of blood through the kidneys; exposure of the patient to cold during operative procedure; operations on the lower urinary tract. (See URINARY FEVER.)

**Treatment.**—The rectal injection of *normal salt solution* is an efficient measure, and should be used freely if there is arterio-sclerosis. *Nitroglycerine* hypodermically if there are evidences of cardiac or circulatory depression. *Strychnine* is a valuable stimulant, and also moderate doses of *Digitalis*.

In cases where there is a tendency to spasm of the renal arteries because of the presence of arterio-sclerosis the administration of nitroglycerine is often followed by a free secretion of urine. (*Therapeutic Gazette*.)

In some cases the use of normal salt solution per rectum

fails to produce diuresis. Hot applications to the region of the kidneys, pilocarpine and alkaline waters may be tried, or nitroglycerine as above. In one case the writer knows of symptomless anuria followed an operation for vaginal hysterectomy and lasted for forty-eight hours, until the ligature was removed from the right uterine artery.

## PASSIVE HYPERÆMIA.

**Synonyms.**—Chronic congestion, venous stasis, passive congestion, cyanotic induration of the kidneys, engorged kidney, chronic hyperæmia, hypostatic kidney.

**Definition.**—Engorgement of the renal veins, due to obstruction of the venous current preventing normal escape of blood from the kidneys. Since the renal veins have no valves, whenever cardiac or pulmonary obstruction to the circulation arises the venous blood is dammed back through the inferior vena cava and renal veins into the kidneys.

**Etiology.**—The causes may be either general or local. Most commonly we find it in (a) mitral regurgitation and stenosis, (b) myocardial disease, (c) pericarditis, (d) emphysema. It also occurs in obstruction or fatty degeneration and dilatation of the right heart, aortic aneurisms, excessive pleuritic adhesions; in chronic interstitial pneumonia, in chronic bronchitis and fibrous phthisis. In death from suffocation an acute form has been noticed.

Local causes which may bring about passive congestions are (a) thrombosis of the inferior vena cava above the entrance of the renal veins, (b) thrombosis or compression of the renal veins which may be due to pressure of tumors, fluids or cicatricial bands, or to extension of inflammatory disease from the kidney itself or to extension of thrombosis from the vena cava. A form of spontaneous thrombosis occurs in cachectic infants suffering from wasting diseases. The pregnant uterus by pressure may also be a cause.

*Clinically* we find passive congestion of the kidneys most common in diseases of the mitral valve, hence the term, "cardiac kidney." The writer has occasionally found it also in cases of long-standing pleuritic effusion.

It may occur also in cases of cirrhosis of the liver. In chronic diseases of the heart it is a sign of weakness of the myocardium sufficient to allow the venous blood to accumulate abnormally in the renal veins.

**Pathologic Anatomy.**—The changes in the kidneys vary according as the congestion is recent or of long continuance. In the latter case the change is characteristically termed cyanotic induration.

*Kidneys.*—Usually enlarged. Thicker than normal.

*Capsules.*—About normal. Non-adherent.

*Renal Surface.*—Smooth, congested, *purple*.

*Cut Surface.*—Appears succulent, but is quite firm; turns deep crimson on exposure to air.

*Renal Substance.*—Very hard. India rubber feel. Color dark.

*Cortex.*—Slightly thickened, dark. Stellar veins of Verheyen very prominent.

*Medulla.*—Deeply congested, darker than cortex.

*Malpighian Bodies.*—Enlarged, distinctly visible.

*Interlobular Veins.*—Prominent, distended.

*Venæ Rectæ.*—Especially congested and distended.

*Pyramids.*—Have striated appearance, due to congestion of venæ rectæ. Bases dark, of purplish hue.

**Summary.**—The marked changes are in the medulla, the bases of the pyramids showing marked congestion, the deeply congested vessels shining prominently between the bundles of uriniferous tubes, causing the tissue to look striated. In cases due to *thrombosis* the kidneys are oedematous as well as hyperæmic.

Microscopically we find :

*Veins.*—Much congested, especially the large ones and the interlobular plexuses.

*Malpighian Bodies.*—Very prominent, Bowman's capsule filled, sometimes distended. Possible rupture of tuft capillaries.

*Epithelium.*—But slightly altered, swollen, sometimes granular, rarely fatty. May contain reddish pigment granules.

**II. Older Cases.**—Macroscopically we find the following:

*Kidneys.*—Slightly smaller than normal; slight degree of granular atrophy. Hard, dark red kidneys.

*Capsule.*—Adherent to nodular surface in places.

*Renal Surface.*—Shows small, pale, wedge-shaped patches of dense tissue, inward along course of interlobular veins.

*Renal Substance.*—Feels almost fibroid.

*Malpighian Bodies.*—More or less atrophied within the patches.

*The Veins.*—Show as dark, vertical striæ.

*Cortex.*—Paler than the pyramids.

Microscopically in the older cases we find a thickening of the capillaries, of the veins, and sometimes even of the arteries. The glomeruli are only occasionally atrophic. The tubular epithelium is more or less degenerated, and in part detached from the basement membrane. Areas of round cell infiltration may be present.

This characteristic change is known as *cyanotic induration*.

In extreme cases the condition may pass into a state of contraction known as *hypostatic contracted kidney*.

**Clinical Features.**—**i.** Those of the primary disorder. Usually we find a patient with a valvular murmur, more or less displacement of the apex beat, greatly engorged liver, and hydrothorax, especially on the right side. There is dyspnœa, which is most marked about midnight, a weak, rapid arrhythmic pulse, and sometimes a hacking cough. There is œdema of the lower extremities and ascites, seldom much œdema about the face. The patient is weak and has periods of great mental depression and anxiety. In long standing cases more or less cyanosis may be observed.

One of the earliest symptoms is dyspncea on exertion.

**The Urine.**—The feature is scanty, cloudy, reddish, acid urine of high specific gravity and with sediment of urates.

*Albumin.*--Small, seldom above second mark on Esbach tube.

*Casts.*--Few, small hyaline, with occasionally a few blood corpuscles in them. A few pale granular casts.

*Sediment.*--Contains mucus and urates, a few blood corpuscles, uric acid crystals.

*Solids.*--Uric acid relatively increased.

Stress is to be laid on the fact that in this disease high colored urine is associated with high specific gravity, 1,020 or upwards. As high a specific gravity as 1,035 has been noticed by the writer. Patients may pass not over ten or twelve fluidounces (300 to 360 c.c.) of urine for weeks or months at a time unless relief from treatment is to be had.

Albumin varies in percentage ; usually by Purdy's centrifugal method the percentage is from five or less to fifteen, seldom as high as the latter unless there is an acute exacerbation or a nephritic complication. The writer has never seen fatty or waxy casts in this disorder before nephritic complication sets in. A noticeable feature is the slowness with which the urine filters after hydrochloric acid has been added to it and it has been allowed to stand twenty-four hours.

The changes in the urine are attributable in the first place to the diminished afflux of arterial blood to the Malpighian tufts; and second, to pressure of the dilated veins upon the uriniferous tubules.

**Differential Diagnosis.**—The color, specific gravity, quantity of albumin and kind of casts are significant in this disorder so far as the urine is concerned, while in the patient presence of valvular disease of the heart and its phenomena are of importance, viz.: The murmur, displacement of apex beat, engorged liver, hydrothorax, ascites, etc. In cases, however, where the hyperæmia depends upon pressure, as

from pleuritic effusion or tumors, much depends upon the history. Effort must be made to discover whether the patient has a history of pleurisy.

Patients may say they have had la grippe, while in reality pleurisy was the disorder, and an effusion is still present. Aspiration may reveal fluid, especially on the right side, which is above 1,015 in specific gravity. In one obscure case of chronic hyperæmia removal of *nine pints* of such fluid resulted in a restoration of the urinary condition to nearly normal.

Passive hyperæmia is to be differentiated from, (a) anæmia of the kidneys; (b) active hyperæmia, and (c) chronic diffuse nephritis, especially from that with induration (chronic interstitial).

The following table will help to differentiate from the last:

PASSIVE HYPERÆMIA.	PRIMARY CHRONIC INTERSTITIAL NEPHRITIS.
Albumin, small.	Albumin, small.
Casts, few hyaline.	Casts, few hyaline.
Volume of urine, decreased.	Volume of urine, increased.
Color, dark.	Color, pale.
High specific gravity and grains per ounce of solids.	Low specific gravity and poor quality of urine. Sp. gr. in acute attacks not so high.
Abundant sediment.	Scanty deposit.
<hr/>	
Dropsy early.	Dropsy late.
No high tension.	Signs of high tension.
No visual disorders or chronic uræmia.	Visual disorders and chronic uræmia.
Cyanosis.	No cyanosis.
Nocturnal micturition not common.	Nocturnal urination the rule.

**Prognosis.**—That of the primary disease. Essentially unfavorable, but depends on the degree of compensation for the mitral defect by hypertrophy of right ventricle. When fatty degeneration or dilatation takes place, death within a few months. Effective compensation may relieve patient for several years.

Tendency to acute intercurrent nephritic attacks is an unfavorable sign.

The urine usually decreases when oedema of the feet and legs appears.

Acute exacerbations due to excesses, indigestion or sudden exposure to cold occur. The urine then is more albuminous, with possibly blood and blood casts.

Intense dropsy and almost complete anuria are not necessarily fatal in this disease.

Temporary improvement often occurs, but relapses are common.

Complication of chronic nephritis is possible if the disease last long enough. Granular casts then appear and remain. Patient may then die in a few days from uræmia.

The writer has seen several patients live for a year or more by virtue of vigorous treatment, when dropsy and dyspnoea were severe and the patient confined to his bed for the time.

The general tendency is gradually downward, with occasional periods of comparative health and comfort. The apex beat is found after a time to be widely displaced and wavy; as the heart dilates the patient grows feebler, and finally takes to his bed. Such a course is more likely in this disease than sudden death during an apparent amelioration, though the latter is possible.

**Cause of Death.**—Death takes place from cardiac paralysis or from suffocation due to excessive hydrothorax or pericardial effusion.

**Treatment.**—In early stages the treatment is that of the primary disorder, usually valvular disease, and will not be minutely considered here.

In general, however, rest alternating with bodily activity, resistant exercises and carbonated baths with remedies directed rather toward keeping up the patient's general health than stimulating the heart itself are valuable.

Illoway's rules for the dietary in chronic heart troubles are the following :

- (a) All foods that have bulk must be excluded.
- (b) All flatulent foods must be excluded.
- (c) Only foods that are readily digestible should be taken.
- (d) All foods must be well cooked.
- (e) All meals should be small.
- (f) There should be sufficient interval between meals.

The diet list for organic heart disease includes fresh eggs and milk, lamb broth, cocoa and crackers, rice and well-cooked farinaceous foods. All food should be well cooked, but never fried. Eating moderately and slowly is also advised. (*The American Journal of the Medical Sciences, March, 1902.*)

**Treatment of the Dropsy.**—The physician will usually be called on to allay the patient's alarm by reducing the dropsy. The writer has succeeded in accomplishing this in a few weeks' time by means of the following treatment:

The patient is put on exclusive milk diet for a period of several weeks. The milk is taken four times daily at regular intervals, as, for example, at 8 A. M., 12 noon, 4 and 8 P. M., in quantity each time from two to six ounces the first week, and from ten to sixteen the second week. If the milk diet is given for three weeks, then during the third week the quantity may be further increased to twenty ounces at a time four times daily. Simultaneously with the adoption of the milk diet the following drugs are administered: Epsom salt in large doses, namely, a heaping tablespoonful dissolved in water, three or four times daily, the fourth dose being omitted as soon as the copious, watery stools relieve dyspnoea sufficiently to allow the patient to sleep at night. Inasmuch as the excretion of urine in these cases is scanty there is need to increase it on account of the danger of uræmic symptoms, notably drowsiness and delirium, which may follow the sudden reduction of the dropsy by the salts. For increasing the urine I give fresh infusion of digitalis in doses of from two to four teaspoonfuls three times daily, alternated with potassium

citrate in doses of from fifteen to thirty grains in plenty of water. If there is as yet no marked failure of compensation the dropsy may be removed by these means in less than three weeks, and the patient, who may at first have measured from forty-eight to more than fifty inches about the umbilicus, is reduced in size until he measures less than forty. During the third week the Epsom salt is decreased in amount given to two doses, or even one dose daily; the citrate of potassium may usually be discontinued altogether in the third week, and the doses of digitalis reduced in amount and in frequency. The patient now begins to take solid food in moderation, avoiding hearty eating and omitting meat altogether from his dietary, but at the same time taking nourishing food. He is allowed all the fresh air he can get without exertion. As soon as possible it is well to discontinue the use of digitalis, and to give China or Phosphoric acid frequently and in material doses. The patient is likely to have relapses from time to time, when it will be necessary to resume the digitalis infusion and give the Epsom salt more frequently for a few days. In one case it has been necessary also to resume the exclusive milk diet every now and then. Finally, if evidences of failure of compensation begin to be shown as by increasing dilatation and tricuspid murmur, the remedies are arsenicum and strychnine, or the arsenate of strychnine. In general, it may be said that if the amount of albumin in the urine is small, usually less than ten per cent. by bulk, if casts are few and not fatty or waxy, and if in the patient arterio-sclerosis or extreme cardiac dilatation is not marked, we can by the treatment described above keep down the dropsical condition for months or even years. In one case thus treated after two severe attacks of dropsy a year apart, the patient, an elderly man, recovered entirely so far as dropsy is concerned, and at the end of four years is still free from it.

If the dropsy is obstinate and resist the action of salts, as occasionally happens, tapping may be resorted to and usually

need not be repeated if the treatment described above be undertaken after the tapping. Occasionally it may happen that the patient cannot tolerate Epsom salt, in which case elaterium in doses of  $\frac{1}{10}$  to  $\frac{1}{6}$  grain once or twice a day may be preferable.

If hydrothorax is marked, aspiration may be resorted to. In one case which I saw this operation was followed by disappearance of general anasarca and ascites for several months. But it is likely to return and the effect of repeated aspirations seems to be bad.

If, for any reason, the patient is unable to undergo the severe purgation above described, reliance must then be placed upon diuretics. There are two great diuretic remedies, digitalis, which acts on the circulation, and theobromine, which acts on the kidneys themselves. The efficiency of digitalis may be increased by administering it in the form of a mixture with strophanthus, the active ingredients of squill, and a glucoside known as oxysaponin, the whole called *hydragogin*; the irritant qualities of theobromine may be lessened by administration of it in the form of a mixture known as *agurin* consisting of five parts theobromine acetate and two of sodium acetate. The activity of agurin is said, moreover, to be much increased when administered in combination with digitalis and it is most efficient in dropsies due to valvular diseases of the heart. It acts upon the kidneys and not upon the heart, hence the more intact the kidney the greater its efficiency. It is best given dry in doses of fifteen grains to adults four times daily.

An excellent combination is the following :

Powdered digitalis leaves, one grain and one-half; agurin, fifteen grains. Make into ten capsules and give one capsule every two hours. Diuretin may be used in case it is not possible to procure agurin.

The writer has used agurin with marked success as a diuretic in one case in which it was advisable to discontinue digitalis and Epsom salt for a considerable period of time.

It is assumed in the above that contraindications to the use of digitalis are not present. These are as follows, according to Edwards :

- (1) Balanced compensation.
- (2) If rest in bed, active purgation, etc., have not been previously attempted.
- (3) Adequate hypertrophy.
- (4) Where danger exists in the direction of vessel rupture, as in very marked atheroma, aneurism, etc., recalling the fact that brain hemorrhage may follow the incautious use of digitalis, strychnia and other drugs which result in over-action of the heart and vaso-motor spasm.
- (5) Marked fatty degeneration of the heart. This does not apply to fatty degeneration *in toto*, but merely to extreme grades of the lesion, since we know that fatty degeneration is often merely an evidence of malnutrition, possibly of stasis, and may be helped by digitalis.
- (6) When the vessels are contracted strongly, we obviate angiospasm by combining the drug with strophanthus, or nitroglycerine, which, especially in aged hearts, is recommended by Balfour. To use his expression, nitroglycerine "unlocks" the peripheral vessels.

When digitalis is given for a long period, it is Edwards' personal preference to combine it with the iodides.

Regarding the cumulative action of the drug, which is denied by many, but nevertheless must be admitted, the drug should be given with intermissions, although it may be kept up in small doses for months, or even years. Great care must be exercised in ambulatory, dispensary, or office patients. Care must be exercised when the drug has been used in dropsy, since sudden absorption of the fluid may result in toxic symptoms, precisely as uræmia may follow disappearance of œdema. Again, toxic symptoms may intervene when the drug has been given during fever, upon whose cessation or crisis toxic symptoms frequently develop.

The indications for the use of digitalis are the following: Dilatation, functional dissociation (hence valuable when there is over-activity of the left ventricle) and rapid heart action.

Colon flushing and injection of warm normal salt solution may aid the diuretics in acting upon the kidneys.

For cardiac dyspnoea and pain *heroin* may be used instead of morphine. It can be given continuously for months in doses of one-tenth of a grain three times daily.

*Strophanthus* in the dilutions (*not* in the tincture) is recommended by Geo. Royal. He says: "Give Strophanthus when the muscular fibers of the heart have been made brittle by rheumatism deposits or by the prolonged and excessive use of alcohol, tea or tobacco; when this condition of the heart muscle has produced a weakness which has interfered with the venous circulation, and has thereby caused passive congestion and an inflammation of the kidneys, which in turn has caused a decrease of the secretion of urine with the resulting dropsical swelling of the extremities, edema of the lungs, impaired vision, etc."

Royal claims that in chronic renal hyperemia strophanthus will decrease the dropsy, and increase the urine when indicated as above. He uses it in the second or third decimal.

*Guarana* is especially indicated in cases of mitral disease and general dropsy. Its diuretic effect is prompt and said to be efficient in dropsy dependent upon cardiac weakness. It is less dangerous than digitalis. It may be given in form of elixir in large doses, a dessertspoonful every two or three hours.

*Caffeine* is also useful in cases when the heart is weak. The dose is from two to five grains four times daily. Either the pure alkaloid or the citrate may be used.

*The weak heart* appearing at the close of this condition may sometimes be strengthened by employment of the faradic brush for two or three minutes daily over the region of the heart, and by application of hot cloths. The most useful

remedies are strychnine,  $\frac{1}{16}$  grain, combined with atropine,  $\frac{1}{64}$  grain, every six hours, in cases where blood-tension is low and *supra-renal extract*, three to five grains, every six hours when the heart is acting against greatly diminished peripheral resistance.

Camphor internally and camphorated oil externally, ether, valerian-root, and ethereal tincture of valerian may also be employed.

It may be remarked here that patients with passive congestion do not bear sweating well and that pilocarpine is not usually to be thought of.

Multiple incisions or puncture, if needed, are safer than attempts at diaphoresis.

**Symptomatic Treatment.**—*Phosphorus*: A prominent indication is a weak, empty feeling in the whole abdomen. Disease of the right heart with consequent stasis. Fatty degeneration of the myocardium; dyspnoea; tightness across the chest; great weakness with inability to exertion, especially indicated in tall, slender patients.

*Arnica*: General dropsy with a bruised feeling. In cases following over-exertion and in fatty heart.

*Digitalis*: Sensation as if the heart would stop beating if the patient moves; hydropericardium; suffocating spells, sinking feeling in the epigastric region, sensation as if about to faint; useful in cases when the congestion is due to enfeeblement of the left ventricle.

*Convallaria*: In hypertrophied and dilated heart with rapid irregular action; general dropsy and lameness in the back, worse on lying down.

*Aconite*: Oppression about the heart, burning flashes along the back; palpitation with feeling as if boiling water were poured on the chest; anxiety, difficulty of breathing, flying heat in the face, sensation of something rushing into the head, faintness with tingling.

Useful in cases of over-action of the heart, which, how-

ever, is uncommon in this disorder. In the writer's experience Aconite is particularly useful in the lower potencies for the sensation of something rushing into the head.

*Belladonna* and *Veratrum Viride* may also be employed, the former where there is a throbbing of the carotid and temporal arteries, the latter in over-action of the heart with a full, hard, bounding pulse. But these conditions are rarely encountered in this lesion of the kidneys.

Other remedies which may be indicated are *Apis*, *Cactus*, *Camphor*, *Chloralum*, *Colchicum*, *Crataegus*, *Kalmia*, *Nux vomica*, *Spigelia* and *Apocynum*.

The writer used *Crataegus* and *Apocynum* with marked relief to the patient in the case of an elderly woman who had been taking *Digitalis* without effect. *Crataegus* was given in ten-drop doses of the tincture, alternately with *Apocynum can.* in seven-drop doses of the tincture alternately every three hours. The patient rallied from an apparently moribund condition and lived several months after the family had gathered together, supposing her to be on her death-bed. Confirmatory of the value of these two drugs is the experience of J. C. Andrews, of Edgewood, California, who gave Lloyd's specific *Crataegus* in five-drop doses in water every three hours, alternated with *Apocynum can.*  $\frac{5}{ij}$ , in water  $\frac{3}{iv}$ , a tea-spoonful every three hours. Andrews's patient, though apparently on the point of death, rallied and lived a week.

## CHAPTER VII.

### INFLAMMATIONS OF THE KIDNEY.

The kidneys are influenced by the blood, and in turn themselves influence the blood. If the blood brings to the kidneys substances which, during elimination, damage them, they in turn, through faulty elimination, modify the state of the blood, which thus altered irritates the kidneys still more.

Richard Bright, 1789-1858, was the first to bring the clinical symptoms and urinary changes into relation with the morbid anatomy of the kidneys. The term "Bright's disease" has been given to inflammations of the kidneys unattended by suppuration. Confusion, however, is unavoidable if the term Bright's disease is used to denote various forms of nonsuppurative renal lesions which were unknown to Dr. Bright. In speaking of inflammations of the kidney the term nephritis is in general preferable. Diseases of the kidneys are, as Riesman says, perhaps the most obscure field in pathology, despite the labors of Dickinson, Stewart, Virchow, Bartels, Weigert, Rosenstein, Senator, von Kahlden, Councilman and Delafield, and no unanimity exists regarding a method of classifying them. Formerly, clinicians distinguished two types of nephritis, parenchymatous and interstitial, but a sharp line between these inflammations cannot be drawn.

Delafield classifies nephritis as follows: Acute exudative, acute diffuse, chronic productive, or diffuse with exudation, chronic productive or diffuse without exudation, suppurative, and tubercular. This classification has been adopted by several authors of text-books on the practice of medicine. From a pathological point of view it is thorough and careful,

but the clinician, as a rule, prefers a classification which, by its nomenclature, gives him a clearer idea of the structures of the kidney affected and of the post-mortem appearances as regards gross pathology. With view, therefore, to the needs of the general practitioner, we shall adopt in this book the classification of Riesman.

According to Riesman (*American Text-Book of Pathology*.) the nonsuppurative lesions are acute nephritis, chronic nephritis, and amyloid kidney.

Acute nephritis is either *parenchymatous*, *i. e.*, one which consists principally of degeneration of the parenchyma, or *diffuse*, *i. e.*, one in which the two chief structures of the kidney, namely, the parenchyma and the supporting tissue, are involved.

The latter form may be chiefly *glomerular* (acute glomerulonephritis), or *interstitial* (acute interstitial nephritis).

Chronic nephritis is either *non-indurative* or *indurative*. The term non-indurative is applied to that form of chronic nephritis in which there is no induration or hardening from scar-tissue or contraction. Post-mortem shows a large, *soft* kidney (large white, or large yellow kidney), except in haemorrhagic cases, where the consistency is greater than normal.

The term indurative, on the other hand, is applied to those forms of chronic nephritis in which there is induration or hardening of the kidney. There are three varieties: (1) Secondary chronic interstitial nephritis, an advanced stage of non-indurative nephritis; (2) primary chronic interstitial nephritis, formerly called granular or contracted kidney, which develops insidiously without evidences of preceding inflammation, and in which, post-mortem, a small, hard, granular kidney is found, and (3) chronic arterio-sclerotic nephritis which in some rare cases may be due to primary arterio-sclerosis in the kidney without noteworthy changes in the interstitial tissue, and in which we find, post-mortem, a hard "beefy" kidney, normal in size or smaller.

The terms non-indurative and indurative are gradually finding their way into the reports of clinicians and pathologists, and in order to have an intelligent understanding of the writings of modern observers the classification above given must be carefully considered.

A classification based upon the part of the kidney affected is both theoretically and practically possible, as we can readily distinguish post-mortem changes in the structures.

#### ACUTE NEPHRITIS.

Clinically we distinguish acute nephritis from chronic as one which arises with comparative rapidity from various injurious influences, and which terminates after a few days or a few weeks either in recovery or in death, or occasionally after a rapid onset passes into the chronic form.

#### ACUTE PARENCHYMATOUS NEPHRITIS.

The writer is a believer in the possibility of clinical demonstration of this form of renal lesion, which is really a degeneration, as the vascular phenomena characteristic of inflammations are absent. Riesman says: It often passes into diffuse nephritis from which it cannot be separated clinically, and only with difficulty at the post-mortem. The writer has, however, seen cases which were degenerative from the first day, and in which death took place before any of the features, clinical and urinary, of diffuse nephritis occurred.

**Pathology.**—The feature is degeneration of the parenchyma of the kidneys, cloudy swelling, dropsical change, hyaline and fatty degeneration, and necrosis.

**Etiology.**—Acute infectious diseases, anaemia, jaundice, pregnancy and poisons are the causes.

**Pathologic Anatomy.**—*The Kidneys.*—Somewhat enlarged and paler than normal. Consistence diminished. Rather friable.

*The Capsule.*—Tense, thin ; strips easily.

*Section.* — Pale surface, less translucent than normal, “cooked” appearance.

*The Cortex.*—Sometimes marked with reddish striæ or dots ; width increased ; bulges a little.

*The Pyramids.*—Darker than cortex.

*Microscopically :* Exudation into Bowman's capsule, and degenerative changes in the tubular epithelium, especially in the convoluted tubules.

**Clinical Features.**—In nearly every acute infectious disease there is probably more or less parenchymatous degeneration of the kidney. In mild cases there are no symptoms. In more severe cases slight albuminuria (febrile albuminuria). In severe cases diminution in the quantity of urine, increase in the color and specific gravity, presence of more or less albumin but of a relatively large amount of casts which are in very large proportion granular. The writer has seen several cases, not, however, of pregnancy, but dependent on jaundice or septicæmia as a cause, where, with only a small percentage of albumin, hundreds, or even thousands, of granular casts could be found on every slide examined.

In the cases thus seen by the writer, oedema and other features of nephritis have been absent and the urine has been entirely free from blood corpuscles or blood coloring matter.

In all the cases referred to the urine was known to be normal before the illness causing the renal change, and yet in a few days casts were found in great numbers and were entirely large dark casts usually significant of advanced degenerative changes. But no evidence of inflammatory changes was to be had in the cases before these casts appeared ; blood and hyaline casts or a large quantity of albumin did not appear first nor any clinical features in the patient significant of acute diffuse nephritis.

**Prognosis.**—That of the disease on which the lesion depends. If the degeneration passes into a diffuse nephritis the

prognosis becomes that of this disorder. In the writer's experience, no matter how many or how large casts are found in the urine in the course of jaundice they invariably disappear if the patient recovers from the jaundice, and the urine then becomes normal.

If the primary cause of the disease cannot be ascertained the prognosis may be grave.

**Treatment.**—The treatment is that of the disorder on which the disease depends. In a general way, however, limitation of the diet to non-nitrogenous food or milk foods, free ingestion of fluids together with remedies, such as the lithium compounds, corn-silk, digitalis if necessary, and possibly jaborandi have been the ones most used by the writer, with special reference to the urinary condition.

#### ACUTE DIFFUSE NEPHRITIS.

**Definition.**—An acute inflammation of the kidney characterized by *simultaneous changes both in the parenchyma and stroma*. There are two sub-classes: Acute glomerulo-nephritis and acute interstitial nephritis.

#### ACUTE GLOMERULO-NEPHRITIS.

**Etiology.**—Acute glomerulo-nephritis is of (*a*) infectious, (*b*) septic, or (*c*) of external toxic origin, sometimes (*d*) due to pregnancy, and sometimes (*e*) follows exposure to cold or is due to unknown causes.

I. *Infectious Origin.*—Secondary to all the acute infectious diseases, principally *scarlet fever*; also to diphtheria, infectious sore throat, cholera, the plague, typhoid, small-pox, erysipelas, cerebro-spinal meningitis, typhus, dysentery, epidemic influenza and even whooping-cough, mumps, measles and chicken-pox; to chronic infectious diseases, as tuberculosis, malaria, syphilis, rarely to dysentery.

Due to passage of soluble specific virus through the kidneys, *i. e.*, products eliminated by pathogenic microbes.

The nephritis of acute articular rheumatism and pneumonia is classified under this heading.

It is probable that a latent and insidious chronic nephritis may cause acute nephritis.

*Clinically*, we find acute nephritis most common in scarlet fever, small-pox, cholera, diphtheria, erysipelas and croupous pneumonia among acute diseases, and in tuberculosis among chronic diseases.

II. *Septic Origin*.—Morbid processes combined with sepsis, suppuration and inflammation; surgical affections, pyæmia, septicæmia, puerperal fever, diphtheritic and valvular endocarditis; certain skin diseases, eczema, acute pemphigus; inflammatory conditions of the lower urinary passages.

In the writer's experience, however, the nephritis, if of short duration in these cases, is likely to be acute parenchymatous rather than diffuse.

Adhesive pericarditis with pus in the pericardial sac is known to have caused a fatal acute nephritis in a child three and one-half years old.

Holst claims that frequently a general infection, clinically speaking, assumes the mask of an acute hæmorrhagic nephritis. He insists upon the close relations between endocarditis and acute nephritis, and concludes that :

1. Acute hæmorrhagic nephritis is, more frequently than is now generally admitted in practice, the expression of an infection of the blood, or in other words, of a latent pyæmia, or of a septo-pyæmia.

2. The transitory hæmorrhagic exacerbations which are so often noted in the course of a chronic nephritis possibly in many cases may be due to a temporary infection of the blood (septo-pyæmia). Perhaps there may be a recrudescence in valvular affections of a hæmorrhagic nephritis similarly to the recurrent lighting up of inflammation in the endocardium. Thus one may speak of a recurrent hæmorrhagic nephritis as one speaks of a recurrent endocarditis.

III. *External Toxic Origin.*—Due to poisoning by cantharides, turpentine, copaiba, cubeb, mineral acids, oxalic acid, carbolic acid, nitre, potassium chlorate, potassium chromate, potassium iodide, phosphorus, arsenic, corrosive sublimate, oil of mustard, scilla, salicylic acid, quinine, and coal-tar products, ether, chloroform, sulphuric acid, glycerine, boracic acid, opium, sharp condiments. External applications of carbolic acid, iodoform, frictions with tar, storax, Peru balsam, petroleum, napthol, chrysarobin, pyrogallic acid, and various ointments for scabies and psoriasis. Ptomain poisoning, as in violent gastritis and intestinal catarrh, is also classified under this heading. Also that of severe burns.

IV. *Other Conditions.*—Acute nephritis is also known to follow sudden chilling, as when a person breaks through ice; exposure to cold and wet, as in battling with snow or wading; and it also occurs in the course of pregnancy.

There is reason to think that even in these cases the nephritis is really the result of infection, though this has not been proved. It is known to occur as an independent infectious disease with *staphylococcus pyogenes albus* in the urine.

A large proportion of all cases of acute nephritis can be referred to a few common varieties of pathogenic organisms. The pneumococcus, the pyogenic streptococci and staphylococci, the bacilli of diphtheria and of typhoid fever, and the plasmodia of malaria, separately and in various combinations, are responsible directly or through their secretions for many cases of acute nephritis. Add to these the renal lesions caused by infectious diseases of unknown nature, as scarlet fever, measles, syphilis, and influenza, and the number of acute cases unaccounted for is not large. (Herter.)

It must not be forgotten that in mild epidemics of scarlet fever there are always a number of cases with no eruption whatever, or an eruption so slight and transient as easily to escape observation, yet cases of acute nephritis may follow these.

Bearing upon the etiology of acute nephritis Blum has shown that of 140 cases 70 per cent. could be traced to acute infectious diseases, while 2.85 per cent. only were referred to cold and 6.42 per cent. to unknown cause. The various diseases investigated showed the following:

Typhoid fever . . . . .	873	cases, acute nephritis,	31
Scarlet fever . . . . .	97	" " "	4
Measles . . . . .	45	" " "	1
Erysipelas . . . . .	162	" " "	7
Variola . . . . .	481	" " "	1
Diphtheria . . . . .	93	" " "	4
Tonsillitis . . . . .	74	" " "	4
Ulcerative endocarditis . . . .	10	" " "	1
Acute rheumatism . . . .	360	" " "	4
Acute pneumonia . . . .	140	" " "	26
Pyaemia . . . . .	12	" " "	8

Blum does not, however, distinguish between acute parenchymatous and diffuse nephritis.

**Occurrence.**—Males are more subject to the disease than females, especially those who are exposed to cold and wet. Alcoholics frequently are attacked by it, possibly, however, from exposure while intoxicated.

It occurs as a complication in gonorrhœa, cystitis, pyelitis, and paranephritis.

Goulkewitch has found evidences of nephritis in 22 of 220 autopsies of infants from 2 to 9 months old.

**Pathologic Anatomy of Acute Glomerulo-nephritis.—*The Kidneys.***—Usually enlarged. Weigh from 400 to 500 grams. Color, grayish-white, grayish-red, or dark red; often mottled with red and white points. Consistency diminished. Organ friable.

***The Capsule.***—Stretched taut, strips easily, adherent in a few places.

***Stellate Veins.***—Well-marked.

***Section.***—Shows cortex to bulge and become convex; cor-

tex wider than normal, and of a dull grayish-pink or grayish-yellow color; striations indistinct; sometimes marked with reddish dots and lines.

*Malpighian Bodies.*—Show as prominent red points.

*Pyramids.*—At juncture with cortex, hyperæmic and red. Elsewhere usually dark red but sometimes pale.

In advanced cases the section of surface is mottled by yellowish or grayish-yellow areas; haemorrhagic foci not disappearing on pressure may also be present. (Riesman.)

*Histologic Changes.* — These are three in number: (1) Glomerular, (2) tubular, (3) interstitial.

The glomerular changes vary greatly; in some cases of acute diffuse nephritis they are slight or even absent; but in the majority they are the most striking, hence the term glomerulo-nephritis. The changes may be either (a) *proliferation of the capillary endothelial cells* or (b) *Proliferative and degenerative changes in the epithelium of the capsule of Bowman*. Both the inter-capillary and the desquamative glomerulitis are accompanied by an increased permeability of the capillary walls, hence the excretion of an albuminous urine. In addition there is also (c) *Adhesive glomerulitis* characterized by an exudation of fibrin, which passes in the form of threads from the inner to the outer layer of the capsule, analogous to an adhesive pericarditis, etc.

The tubular changes are principally degenerative, with a few proliferative, most marked in the convoluted portion, and in character as in acute parenchymatous nephritis. The lumen of the tubules contains granular detritus, tube-casts, detached cells, hyaline masses and red blood corpuscles. In some cases desquamation is marked, hence the term *desquamative nephritis*.

The changes in the interstitial tissue are as follows: (1) Exudation of fluid; (2) emigration of leucocytes; (3) diapedesis of red blood cells often amounting to distinct haemorrhages; (4) proliferation of the fixed connective tissue cells;

(5) appearance of the so-called plasma cells of Unna; (6) alteration in the blood vessels.

When the haemorrhagic process is intense, the term *acute haemorrhagic nephritis* is used.

In the acute nephritis of scarlatina and diphtheria the changes in the interstitial tissue are most marked.

**Onset of the Disease.**—In cases due to exposure the onset is usually rather sudden, in those due to fevers less so. The patient gradually becomes pale, and puffiness in the face or oedema of the ankles is first noticed. In cases due to mineral poisoning a typhoid condition sets in after subsidence of the acute toxic symptoms.

**Clinical Features of Acute Glomerulo Nephritis.**—The principal features are *oedema, anaemia, and diminished secretion of urine*, the latter containing *blood, albumin* and *casts*. In young children *convulsions* may be the first symptom noticed. Chills, fever, pain, nausea and vomiting may also occur as well as a large number of symptoms, which are more conveniently grouped as follows:

**The Eyes.**—These appear swollen, due to oedema of the lids, which is an early and common feature. In the eye itself haemorrhagic retinitis occurs in some cases.

**The Head and Face.**—Intense headache, especially before uræmic attacks.

The face is pale and oedematous. Cutaneous oedema of the face may be the earliest or only symptom, the eyelids particularly being swollen and a remarkable narrowing of the palpebral fissure noticed.

The soft palate, larynx and glottis may become oedematous as also the conjunctiva. There may be subconjunctival haemorrhage.

**The Skin.**—There may be marked oedema under the entire skin to such an extent as to cause rupture of it. The skin is dry, anaemic, and of translucent appearance.

Erysipelas or gangrene may develop as a result of inflammation of the skin from oedema.

*Respiratory Tract.*—There is dyspnoea from hydrothorax, hydropericardium and ascites.

A form of pneumonia sometimes develops.

Pulmonary oedema is not rare and oedema of the glottis may occur.

*The Heart and Arteries.*—The blood pressure is increased, the aortic second sound accentuated often to a ringing character; sometimes there is hypertrophy of the left ventricle. Acute dilatation of the heart may rapidly develop with fatal issue.

Epistaxis and subconjunctival haemorrhages are noticed, also haematuria.

*The Temperature of the Body.*—This may be unchanged, but, as a rule, it is elevated at times as high as  $102^{\circ}$  or above. In young children temperatures from  $101^{\circ}$  to  $103^{\circ}$  may be noticed for a few days. Chilliness and rigors are noticed in a few cases.

*The Muscles and Nerves.*—Pains in the muscles and joints are common. Severe backache may precede an attack of uræmia. Severe bilateral sciatic neuritis has been noticed.

*The Pulse.*—Is often hard and tense; at first, slow, but later, accelerated.

*The Gastro-Intestinal Tract.*—There is loss of appetite, but increased thirst. Nausea and vomiting are common, sometimes diarrhoea.

*The Urinary Tract.*—There is usually frequency of micturition and there may be difficulty in voiding urine, with vesical tenesmus and pain.

*The Blood.*—There is anæmia; diminution in red corpuscles and per cent of haemoglobin is noticed. It appears early and is very generally present.

*Uraemia.*—Early in severe cases; the symptoms are severe headache and backache, vomiting and convulsions. Sleep is disturbed and appetite lost. Transient aphasia may occur. Uraemia occurs in only a limited number of cases, some-

times in the beginning, more often, later. It is most common in scarlet fever cases.

**Dropsy.**—The dropsy may follow the acute initial symptoms in a day or two and rapidly increase, or may gradually appear during convalescence from the acute infectious disease. Puffiness of the eyelids is usually first noticed, followed by involvement of lower extremities, genitals, and dependent parts of the trunk.

The dropsy is most common in (a) post-scarlatinal cases, (b) those due to malaria, (c) pregnancy, and (d) exposure to cold and unknown causes, (e) in alcoholic cases, (f) in cases following cutaneous diseases, as scabies or pustulous eczema. A violent and rapidly fatal nephritis may be accompanied with but little dropsy.

The dropsy that distinguishes renal disease in the absence of cardiac lesions competent to account for the symptoms is probably due to alterations in the smallest blood vessels and in a very large proportion of cases is associated with well-defined glomerular lesions in the kidney, these in turn probably dependent on the action of toxic substances or pathogenic organisms which reach the kidney in the blood stream. That is, certain poisons in the blood are capable of producing both glomerular lesions in the kidneys and changes in the vessels of the skin which permit the transudation of serous fluid. The dropsy may be in some cases due also to weakness of the heart, in which case it is congestive.

In nephritis oedema begins in the skin, notably in that of the face. It is sometimes slightly inflammatory, as shown by the redness and tenderness of the skin. In some cases there may be dropsical transudations into serous cavities (hydrothorax, ascites, hydropericardium) without oedema of the skin. Oedema of the mucous membranes also occurs: of the conjunctiva, soft palate, glottis, etc., and resembles a mild local inflammation. Lastly, there occurs oedema of the internal organs, as, for example, pulmonary and cerebral, which is sometimes inflammatory.

The dropsy is a thin blood-serum, composed of from 97 to 98 per cent. water, one and one-half per cent. salts, a little albumin and a little urea.

**Secondary Inflammations.**—During nephritis secondary inflammations may appear in almost all the internal organs, and often quite suddenly, especially in the retina.

**The Urine.**—Is diminished in amount and contains albumin, blood and casts in a majority of cases. The color is light red, like meat water, or red-brown or brown-black from methemoglobin. Clots are absent. The sediment in addition to blood corpuscles contains cylindrical structures of adherent haemoglobin. The specific gravity is high at first, 1.020 to 1.025, but later falls to 1.015 or 1.010. Haematuria is marked in the cases known as nephro-typhoid.

**Atypical Cases.**—1. In some cases the entire clinical picture is that of acute meningitis; fever, prostration, restlessness, sleeplessness, delirium, headache, stupor, typhoid state, with little or no dropsy; absence of albumin, casts and blood from the urine, but presence of pus.

2. In children, fever, gastro-intestinal symptoms, drowsiness, mild convulsive seizures or simply anaemia may be the only symptoms of an acute nephritis.

3. There may be no symptoms to attract attention except abdominal pain, speedily followed by coma.

4. Cases are described by Delafield in which there is high fever, typhoid, cerebral and circulatory symptoms with anaemia and dropsy mostly in the legs. Blood is absent from the urine and casts few. Albumin in the urine is abundant. There is dyspnœa, vomiting and diarrhoea. The patients rapidly lose flesh and strength until convulsions or coma take place, sometimes preceded by acute mania, and death. To this disorder Delafield gives the name of acute productive nephritis.

**Duration.**—In cases due to exposure the duration varies from a few days to three or four weeks. Post-scarlatinal cases

may persist four to eight weeks. In other fevers the course is much more rapid.

Occasionally the disease takes the form of exacerbations and remissions extending over several weeks.

**Prognosis.**—Usually favorable; least favorable in scarlet fever cases in which one-third are fatal.

**Dangers.**—*Suffocation* from hydrothorax and pressure on the lungs or from oedema of the glottis or lungs; *uræmia* with high temperature and cardiac paralysis; *inflammations of internal organs*, secondary pneumonia, rarely pericarditis and peritonitis; *inflammation of the skin* (from oedema) with *septicæmia*; *development into chronic nephritis*.

Cases of suppression of urine lasting from twenty-four to forty-eight hours usually terminate fatally.

Having considered acute glomerulo-nephritis in general, let us now glance at acute nephritis as it manifests itself in various diseases.

#### ACUTE POST-SCARLATINAL NEPHRITIS.

**Pathology.**—The most frequent type is, as a rule, a glomerulo-nephritis, but glomerular changes are not a necessity. In some cases an acute interstitial variety is found. Congestion of the vessels and fatty degeneration of the epithelium are present in practically all cases. If death occurs early the kidney shows very slight macroscopic changes; if death has occurred at the height of the disease the kidney is usually enlarged, flaccid and either pale or red from haemorrhages or congestion.

**Clinical Features.**—The symptoms begin anywhere between the fourteenth and twenty-second day of the fever. There is a slight rise of temperature, puffiness under the eyes, frequency of urination which is sometimes painful, and slight pain in the back; oedema increases until general dropsy is present, with difficulty of breathing, dimness of vision, waxy

pallor, anaemia, vomiting, drowsiness, and stupor. The urine decreases in quantity and contains albumin, blood, and casts. In severe cases there is rapid diminution in the volume of the urine until suppression takes place, followed by coma or convulsions.

*The Urine.—Micturition.*—Frequent.

*Quantity of Urine.*—Decreased. In severe cases may be only six or eight fluid ounces per twenty-four hours, or suppressed entirely. Frequently less than a pint.

During convalescence slight polyuria, one hundred fluid ounces (3000 c. c.) in twenty-four hours possible.

*Color.*—High colored, opaque, dirty-red (smoky) from blood.

*Reaction.*—Acid.

*Specific Gravity.*—Usually 1.020, but may be higher.

*Urea.*—Grains per ounce: increased; grains total: decreased.

*Chlorides.*—Diminished.

*Uric Acid.*—Increased, relatively.

*Albumin.*—Abundant: Fifth mark on Esbach tube, or even much more possible. May be small or even absent at first; may disappear temporarily; may persist after other symptoms disappear.

*Sediment.*—Abundant: casts abundant; hyaline first then epithelial, leukocyte and blood casts plenty; granular casts present; a few fatty. Blood corpuscles and shadows, pus corpuscles, renal epithelium, uric acid, urates.

*Prognosis.*—Two cases out of three recover, but the prognosis in any case depends upon various conditions. In severe cases death may take place on the second or third day.

*Favorable Signs.*—Urine less dark and less scanty before end of first week, and at end of two weeks quantity of urine not much below normal, and at end of four weeks but little albumin. A trace of albumin may be present for months and finally disappear.

**Unfavorable Signs.**—Severe symptoms early in the case; suppression of urine or scanty, bloody urine early. If granular and fatty casts are numerous at end of sixth to eighth week, chronic nephritis is likely to ensue. Numerous pus corpuscles in the sediment are thought a bad sign.

In scarlatinal cases it is noticed that recovery sometimes takes place even when uræmia, anuria, and pulmonary œdema occur; on the other hand, death may unexpectedly occur in spite of apparently unimportant symptoms.

Convulsions early in the case and numerous large, dark, granular and especially waxy casts with a high percentage of albumin have been noticed by the writer in fatal cases.

Fürbringer has noticed that in the majority of his fatal cases the urine was only slightly or not at all haemorrhagic. An increase in the dropsical symptoms with small, rapid low-tension pulse, and increasing albumin in the urine, are grave symptoms. Scarlatinal nephritis should show an improvement in from seven to ten days, but complete recovery has been known after eight or ten weeks, and it is claimed even after a year.

**Duration.**—Under favorable circumstances improvement in a week or ten days, and recovery takes place in about four weeks. As a rule, if the disease lasts six months it is to be regarded as chronic. Albumin may leave the urine in favorable cases entirely at the end of four weeks. The writer has seen cases where a trace persisted for five or six months without development of chronic nephritis and with subsequent complete recovery.

**The Dangers** are, (*a*) extension of dropsy to chest with pulmonary œdema; (*b*) anuria and uræmia; (*c*) cardiac failure; (*d*) chronic nephritis with retinitis; (*e*) extensive inflammation of external organs. Removal to a hot climate during or just after convalescence will sometimes prove to be beneficial.

**The Important Complications** are pericarditis, retinitis and serous inflammations, diffuse bronchitis and a peculiar pneumonia midway between catarrhal and croupous.

## ACUTE NEPHRITIS IN VARIOUS DISEASES.

In *measles* it is rare. We find the usual cloudy swelling and fatty change in the tubular epithelium, also degenerative changes in the capsule. Clinically, it resembles post-scarlatinal. The nephritis of *chicken-pox* is like that of scarlet fever. It is rarely seen. Dropsy and fatal uræmia may occur. It may be latent, slight or serious. Acute nephritis is also rare in *influenza*. If present is either degenerative or glomerular, rarely haemorrhagic. In *erysipelas* nephritis occurs in about five per cent. of the cases. In such cases fever and the skin affections disappear quickly. Occasionally *erysipelas* nephritis runs a slow course, or may even become chronic. In *malaria* the general appearance of the kidney suggests the action of a toxic rather than of an organized agent. In acute cases there is, as a rule, no macroscopic change in the kidney. Microscopically we find pigmentation of the glomeruli and at times of the inter-tubular capillaries. The malarial parasites are common in the capillaries of the stroma. Capsular epithelium undergoes degeneration and desquamation, and an albuminous exudate is present in the capsular space. The epithelium of the convoluted tubules is likewise degenerated, and tube-casts are numerous. The nephritis has a tendency to become chronic and to develop into contracted kidney.

In *small-pox* a great quantity of blood may be found in the urine, but, according to Rosenstein, the source of it is more frequently in the renal pelvis.

*Whooping-cough* is sometimes attended by acute nephritis, which may terminate fatally.

In *infectious sore throat* there may be acute nephritis with dropsy, but it is rare.

*Acute arthritis* rarely may be followed by acute nephritis, which occasionally is severe or fatal with intense albuminuria and oedema.

## ACUTE DIPHTHERITIC NEPHRITIS.

**Pathology.**—There are no characteristic lesions. Degenerative changes in the epithelium are always present, frequently with more or less pronounced alterations in the interstitial tissue (accumulations of plasma-cells) and in the glomeruli. Glomerulo-nephritis is especially common in older children and in cases of prolonged duration. The lesions are not due to bacteria but to toxic substances in the blood. The diphtheria bacillus may, however, be present in the kidney on culture.

Councilman has found acute interstitial nephritis to occur in diphtheria 24 times in 103 cases. (See ACUTE INTERSTITIAL NEPHRITIS.)

**Clinical Features.**—The nephritis appears in the majority of cases at the acute period of the diphtheria. The urine occasionally, but not usually, contains blood and the patient is seldom dropsical. Anuria and uræmia are not common. Characteristic pathognomonic renal symptoms are usually wanting and for this reason the renal lesion is often unrecognized. There is sometimes, however, an enormous amount of albumin, as much as two per cent. *by weight*, in the urine. Degenerated renal epithelium is abundant in the sediment, but red blood corpuscles not so. The casts and cylindroids have a peculiarly opaque appearance in consequence of epithelial debris. The course of the disease is less variable than that of scarlatinal nephritis and rapid recoveries from even severe cases are not uncommon. Cases which have lasted for years have been known to recover.

The writer has seen several cases, all of which proved fatal, though in some the death was not attributed to the renal lesion.

## ACUTE NEPHRITIS IN PNEUMONIA.

**Pathology.**—There is nothing characteristic in the pathology. Degenerative changes—cloudy swelling and fatty

changes—are found in the epithelium of the convoluted tubules. The glomeruli are usually intact. Hæmorrhages are not infrequently present. The renal changes are not due to the pneumococcus, but the result of its toxin. The *previous* existence of renal disease usually brings about a fatal termination in pneumonia, but the acute nephritis of pneumonia is seldom fatal. Acute interstitial nephritis sometimes occurs in pneumonia.

**Clinical Features.**—The nephritis usually begins on the third to the sixth day, or from the fourth to the eighth of the disease, and is characterized by the presence of albumin and casts in the urine, and sometimes of blood. In the writer's experience the casts seen have been usually granular and dark granular, as in acute parenchymatous nephritis. If the patient recover the nephritis may disappear, but occasionally it becomes chronic. (The presence of a slight acute parenchymatous nephritis is noticed in many cases of pneumonia by the occurrence of a slight albuminuria, which disappears as the patient recovers.)

As a rule, the acute nephritis of pneumonia remains intense only about a week, and in no way influences the primary disease. œdema is said sometimes to be present. The prognosis is usually favorable.

#### ACUTE NEPHRITIS IN TYPHOID FEVER.

**Pathology.**—The kidney is enlarged and congested, and the seat of punctiform hæmorrhages. Cloudy swelling and fatty changes in the convoluted tubules and loops of Henle are present. In rare cases there is a distinct glomerulonephritis.

**Clinical Features.**—The slight acute parenchymatous nephritis, whose only feature is albuminuria, with or without cylindruria, is common in typhoid as in other fevers. Osler found it in forty-six out of seventy-five cases of typhoid.

More rarely a genuine acute hæmorrhagic nephritis occurs with fever, backache and scanty albuminous, bloody urine. Osler found this form in two out of seventy-five cases of typhoid. It may occur in the beginning of the disorder, masking for a time the true nature of the malady, or at the end of the first or second week. Dounadieu reports a case in which with scanty, highly albuminous urine there was very pronounced dyspnœa, signs of pulmonary œdema, incessant vomiting, delirium and a relatively low temperature. The renal symptoms gradually subsided, and the temperature crept slowly up.

More common but less serious is a mild form during convalescence. It develops after the fall of the fever, and is usually associated with œdema.

Sometimes it may happen that after the temperature seems to have fallen definitely it rises again. In such cases the urine should be carefully examined for signs of nephritis.

#### THE ACUTE NEPHRITIS OF YELLOW FEVER, CHOLERA, AND THE PLAGUE.

In yellow fever nephritis the kidney is normal in size or slightly enlarged and the color pale-yellow or unaltered. The microscopical feature is extensive fatty change in the epithelium of the tubules.

In cholera, if death occurs not early, the kidney has a violet hue, and later still, is slightly yellowish. On section the organ has a sticky glabrous feel which is deemed of considerable diagnostic importance. The causes of the renal changes are probably due both to the profound depression of the circulation and to the cholera toxin. The urine is frequently totally suppressed; if any is voided it contains albumin, ammonia, and acetone. Indican and ethereal sulphates are increased.

In the plague nephritis is common in severe cases, but is

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not peculiar to the disease. The usual features of acute diffuse nephritis are found in the urine, but the presence of blood is said to be due to lesions in the lower parts of the urinary tract.

#### ACUTE NEPHRITIS IN GASTRO-ENTERITIS.

Koplik has noticed that nephritis frequently complicates gastro-enteritis in children, at least in serious cases, and calls attention to three symptoms which should attract the attention of the physician :

1. Restlessness; incoercible and persistent vomiting, and cutaneous oedema. Restlessness of uræmic origin is characterized by its persistency and by its alternation with periods of stupor.

2. Vomiting of renal origin is not affected by washing out the stomach nor by a strict diet, distinguishing it from that of gastric origin.

3. The oedema is less apparent than in Bright's disease in adults, and it may be overlooked if not sought for. The anterior parts of the lower limbs and dorsa of the feet are the places of predilection. To dent the flesh one must press down forcibly.

Children with such symptoms present albuminuria, casts, renal epithelia and red blood corpuscles. The quantity of urine is also more or less diminished. The outlook is favorable if the toxins be eliminated by energetic and appropriate treatment. Therapeutically, he advises washing out the stomach and rectum several times a day with a solution containing 4 per cent. of sodium chloride and 3 per cent. of sodium carbonate, leaving some in the intestine to be absorbed to stimulate the kidneys. In more serious cases he injects two hundred ccms. hypodermically. During the whole period the child is fed on albumin-water diluted with lime-water. Internally he employs the subnitrate of bismuth in large doses. (*Hahn. Monthly from La Settimana Medica.*)

ACUTE NEPHRITIS FROM EXPOSURE TO COLD, ETC.

This form or that due to unknown causes may appear rather suddenly without any demonstrable cause, or it may follow a marked chill. The features are often as follows: Chill, fever, pain in back and in bladder, difficult and frequent micturition, diminished volume of urine, dropsy; in severe cases these initial symptoms are followed by cerebral symptoms, coma or convulsions in from twenty-four to thirty-six hours, albuminous urine, etc.

Œdema may be absent in some cases, but usually dropsy appears in a few days after the initial chill. The prognosis is usually favorable, and development of chronic nephritis unlikely. In some cases blood appears in the urine from time to time for months. Sometimes the first symptom is vomiting, in other cases œdema or puffiness of the face and slight dyspnoea due to hydrothorax. The course may be either mild or severe; in mild cases there is but slight œdema and not an excessive amount of albumin and blood in the urine. In severe cases there is much blood in the urine with great general dropsy and uræmia. In the severe cases death may take place in three or four weeks or sooner. Recovery, however, has been known from even the severest cases. After an apparent recovery there may be a relapse weeks or months later. In such a case the term *acute recurrent nephritis* is used.

In the cases of *unknown origin* there is frequently septic infection of some sort as from a mild sore throat, or insignificant gastro-intestinal disorder, or from slight purulent affections as boils or eczema.

ACUTE ALCOHOLIC NEPHRITIS.

This occurs especially among brewers and heavy beer drinkers. It may be favored by exposure to cold, but is

essentially toxic from alcohol. The features are a rapid and great development of general dropsy, a diminished and highly albuminous urine, which, however, seldom contains blood. Recovery is possible, but there is danger of the disease becoming chronic.

**Prognosis.**—As a rule, *the prognosis* in the numerous diseases mentioned above is favorable, *i. e.*, disappears on recovery from the primary disorder. Scarlet fever nephritis is of course an exception. Fatal cases of acute nephritis have been known to occur from measles, chicken-pox, whooping-cough. Chronic cases have been known to develop from erysipelas, malaria, and pneumonia as well as from other diseases.

#### ACUTE INTERSTITIAL NEPHRITIS.

The non-suppurative form of this lesion has been studied by Councilman, Biermer, Klein, Friedländer and Sörensen.

**Definition.**—An acute inflammation of the kidneys affecting principally the interstitial tissue or stroma, which is affected by general and focal infiltration with cells which correspond to those known as Unna's plasma cells.

**Etiology.**—It is frequently the result of acute infectious diseases, particularly those of childhood. Councilman found it 24 times in 103 cases of diphtheria, and 5 times in 20 cases of scarlet fever. It also occurs in measles, pneumonia, whooping cough, acute endocarditis, and epidemic cerebro-spinal meningitis. It occurs in scarlet fever which is accompanied by diphtheria. Bacteriologic examination of the kidneys has for the most part proved negative in cases of acute interstitial nephritis.

**Pathologic Anatomy.**—*The Kidneys.*—Normal in size or but slightly enlarged. Sometimes two or three times normal in weight.

*The Capsule.*—Distended. Strips easily.

*The Surface.*—Pale-grayish, opaque, somewhat like amyloid kidney, mottled with irregular hyperæmic areas.

*The Stellate Veins.*—Injected and often surrounded by small opaque nodules.

*Section.*—Shows normal markings obliterated and the contrast between medulla and cortex obscured.

*The Cortex.*—Greatly increased in width—to three or more times the normal.

*The Glomeruli.*—Not prominent, and usually invisible.

*The Surface of Section.*—Grayish and opaque, and marked with small hyperæmic and ecchymotic areas.

*The Pyramids.*—Darker than the cortex. Areas more opaque than the general cut surface are seen extending in lines from the pyramids through the cortex.

*The Renal Tissue.*—Soft, friable, moist, and on pressure exudes an opaque milky fluid. The same may be scraped from the surface with the knife.

The changes are often most marked at the bases of the pyramids in the intermediate zone. At times there is a striking discrepancy between the macroscopic and microscopic changes.

*Pathologic Histology.*—The feature is an intense cellular infiltration in the interstitial tissue or stroma, particularly marked at the bases of the pyramids, the border zone beneath the capsule and about the glomeruli. The cells are identical with Unna's plasma cells. The tubules are widely separated by areas of interstitial tissue, and their epithelium presents various degrees of degeneration. The glomeruli show no essential changes apart from periglomerular accumulation of plasma cells.

*Clinical Features.*—About the only clinical feature noticed by Councilman has been albuminuria. Biermer has noticed renal symptoms two weeks before death, namely, diminished urine, dropsy and uræmia. Sørensen noticed slight œdema and ascites in one case, that of scarlet fever with severe septic diphtheria.

The course is rapid, and in some cases the urine becomes normal before death from the primary disorder takes place.

#### TREATMENT OF ACUTE NEPHRITIS.

The modern view of the treatment of acute nephritis is based essentially on an effort to rid the body of the noxious materials which are causing the inflammation. With this end in view, (1) the diet is to be such as to cause the least irritation to the kidneys by curtailing the supply of toxins; (2) the kidneys are to be flushed with large amounts of water taken internally; (3) the colon flushed to remove intestinal toxins and also to stimulate the activity of the kidneys; (4) and the skin rendered active by hot baths or packs. Comparatively little value is attached to the use of drugs, which, if given at all, should be for certain special purposes and in carefully regulated doses.

The details of the treatment are as follows:

In scarlet fever cases milk diet throughout the fever, rest and avoidance of the slightest chill will sometimes prevent the onset of nephritis.

When premonitory symptoms show themselves by marked increase in arterial tension or presence of blood in the urine, a saline cathartic, in case of children fluid magnesia, will sometimes avert the onset of the disease.

If, however, the disease is thoroughly established, the following measures must be adopted:

*Diet.*—As a general thing well-boiled milk is to be preferred for diet; one and a half to two quarts daily may be given at frequent but regular intervals, and taken in small quantities at a time, not swallowed in large amount.

The milk may be mixed according to the taste of the patient with weak tea or coffee, with plain soda water, French Vichy or lime water; a little salt or a few drops of brandy may be added to it, or it may be mixed with arrow-root gruel. When, however, the urine is nearly or wholly suppressed the patient

must live on arrow-root gruel only, for the time being. After improvement sets in fresh buttermilk, milk-gruel with rice, flour-gruel, malted milk, Kumyss, barley-water and oatmeal water are allowable, and usually after a week or ten days clear vegetable soups, light broths from pigeon, fowl or veal, and even eggs may be allowed but no meat extracts should be given.

At the end of two or three weeks, usually, it will be allowable to give solid foods; rice may be taken in form of thin broth or plain pudding, bread and butter, lettuce, water-cress, sweet potatoes, grapes and oranges. If albumin in the urine is in large amount and not decreasing, defer giving solid foods until improvement is noticed.

*Thirst* is often a feature of the disease, and the patient should be given an abundance of fluids not only for relief of the thirst but also as a therapeutic measure. As much as five or six quarts of water a day may be needed, and it is best given hot. If the thirst is excessive it may be relieved by giving a pint of water boiled and cooled, containing one drachm (4 grams) of cream of tartar together with the juice of half a lemon.

When nausea or vomiting is a feature the patient may be unable to take liquids in any considerable amount. In such cases they must be given him in teaspoonful doses every five to fifteen minutes until the stomach tolerates larger amounts, even when coma or convulsions are present.

**General Hygienic Measures.**—The patient is to be kept indoors throughout the whole course of the disease, clothed in a woollen night-dress, and kept quiet, in a room of the temperature of 72° F.

Good ventilation is desirable, but on no account is the patient to be exposed to draughts.

Albuminuria and haematuria are known to be aggravated in cases where the patient is allowed to get out of bed incautiously without regard to the temperature of the room.

As long as albumin in appreciable quantity is found in the urine it is prudent to keep the patient indoors.

**Bathing.**—The patient is to have a tepid bath in water of a temperature of 95° F., twice a day, morning and evening. The duration of the bath is not to exceed fifteen minutes. He is to be rubbed with a dry, warm towel, after which he is to put on a warm night-gown and return to a bed warmed with hot water bottles. His bed-room should adjoin the bathroom. In some cases it is better to wash the skin every day, one member at a time in tepid water, and rub dry.

Adults may usually be put into a hot bath for fifteen or twenty minutes then rubbed dry.

In cases of uræmia the hot wet pack or hot air bath may be necessary. (See further on.)

**Care of the Bowels.**—It must be the rule that the patient have a thorough movement at least once a day, but active purgation is usually to be avoided. Obstinate constipation may require thirty grains of jalap or  $\frac{1}{10}$  grain of elaterium.

As a rule, when necessary, the so-called drastic cathartics are preferable, as senna, Epsom salt, gamboge, etc.

Instead of cathartics high flushing of the colon every four hours is to be remembered, followed by rectal injection of a pint of normal salt solution which should be retained. The records of Cook County Hospital, reported by Dr. F. W. Wood, show the beneficial effects of this treatment :

Œdema of the extremities rapidly disappears, headache and backache cease to annoy, the mind clears, the appetite is stimulated, and, best of all, the whole intestinal tract becomes active, so that toxic elements, which are said to play so important a rôle among the etiological factors of nephritis, are quickly and efficiently eliminated. This is accomplished, too, without the use of active cathartics, which are certainly open to some objections. The cases reported by Dr. Wood also show that we may expect to obtain from this simple adjuvant treatment marked diuretic effects. The amount of urine

passed in some of his cases reached 156 ounces during the twenty-four hours. It does not seem to matter whether the acute nephritis is a complication of one of the infectious diseases or not; in either class of cases colonic flushings are useful.—(*Hahn. Monthly.*)

The writer has, however, seen in private practice several cases where children would not tolerate such vigorous measures, and the physician attempting them was dismissed and some one else called in.

**Symptomatic Treatment.**—*Aconite.*—In post-scarlatinal cases or those due to exposure to cold; early stages where there is either a bounding pulse and hot skin, or a tense small pulse and cool surface of the body. The patient is anxious and there is irritability of the stomach. There is rapid development of anasarca, restlessness and soreness in the lumbar region.

Use the first decimal, or ten drops of the tincture in four ounces of water, a teaspoonful every two hours.

*Apis.*—When dropsy is a feature, especially about the face with headache early in the case and severe, use Apium virus, third decimal. Apis in the third decimal has recently been reported to have cured in eight days a girl of 18 years. The symptoms were greatly swollen face, skin tense and pale, pitting on pressure; general anasarca, rapid, strong heart action, and albuminous urine. The remedy was given in doses of three drops every two hours, with rest in bed and milk diet. Symptoms calling for this remedy are rapid development of anasarca, sudden swelling, generally first on the eyelids; oedematous parts have a waxy hue; there is backache, headache and aching of the limbs, but no thirst. There is great dyspncea and suffocative constriction about the throat. The mental condition is torpid. If convulsions occur they are tonic and clonic. There is aggravation the latter part of the night, and relief from sitting erect.

Cowperthwaite gives this remedy first place in acute nephritis, and uses the third decimal.

*Arsenicum*. — Useful in subacute cases slow to recover, tendency toward the chronic; the patient is pale, waxy, anaemic, restless, has difficulty of breathing, especially about midnight, is dropsical, has extreme thirst for small quantities, and is very weak. The stomach is very irritable, with constant burning, and a feeling of pressure. The pulse is small, rapid and weak, and there is dyspnoea and symptoms of pulmonary oedema. Use the second or third decimals, or drop doses of Fowler's solution every four to eight hours.

*Arsenite of copper* is recommended by Goodno for uræmic conditions. Dose three grains of the second or third decimal every half an hour to two hours. The remedy possesses a most remarkable influence over uræmic convulsions, improvement being usually apparent in from two to four hours.

*Apocynum can.*—Acute nephritis with scanty, dark urine, great thirst but nausea from drinking water, feeling of oppression about the epigastric region and the thorax; irregular, feeble, intermittent pulse; stupor with mechanical movements of one arm or leg. Useful in cases of dropsy, which may be treated with liberal doses of the tincture or infusion. Children should be given two-drop doses of the tincture, which may be increased if necessary until nausea is complained of.

*Belladonna*. — Fever, flushed face, headache, vomiting, scanty, bloody urine. Following Aconite in early stages. Suited to congestion of the glomerular capillaries. Use second or third decimal, not the tincture.

*Cantharides*.—After fever has subsided but urine is still scanty, bloody, and highly albuminous, voided in small quantities with pain and straining. Use the first decimal or even drop doses of the tincture, three to eight times daily. Useful in those cases wherever abnormally concentrated urine causes frequent micturition with a disagreeable, painful sensation. There is burning, stinging, and tearing pain in the region of the kidneys, pain in the loins, and over the abdo-

men. The remedy is suited to uræmic conditions, delirium and coma with a high fever and full, hard pulse. Cowperthwaite uses the third decimal.

*Cicuta virosa*.—The principal indication for this remedy is the subsultus tendinum so often observed in uræmic conditions.

*Helleborus niger*.—Violent pains in the head, mental torpor, imperfect vision, nausea, vomiting, dropsical conditions, with frequent desire to urinate. Serviceable in dropsy with scanty high colored urine. Give five drop doses of the tincture in water every two or four hours. It is one of the ingredients of Macy's diuretic mixture.

*Ferrum*.—This, in the writer's experience, is a most useful remedy in lingering cases where long-continued anæmia and weakness are the features. It may be given to children in the form of the phosphate or iodide. Stubborn cases may require teaspoonful doses of Basham's mixture in plenty of water or the same of Boudreaux's syrup, four times daily, but not when headache and constipation are present or there is a high-tension pulse.

The indications for the remedy are anæmia with pale face and lips and great debility; pallor of the mucous membranes, especially that of the buccal cavity; bellows-sound of the heart, and anæmic murmur in the arteries and veins; the muscles are feeble and easily exhausted from slight exertion; there is œdema of the body.

The above is a truthful picture of many cases which the writer sees and which are materially helped by the administration of iron. It is hardly a remedy for acute nephritis, but the writer has seen cases where this disorder merged into the subacute form rapidly (in three weeks) and all the indications for iron appeared.

*Jaborandi*.—This drug is valuable when uræmic symptoms are alarming. (See SPECIAL THERAPEUTIC MEASURES.)

*Mercurius dulcis*.—This is a valuable remedy when there is severe headache, nausea and vomiting.

*Mercurius cor.*—Long lasting cases after dropsy is gone; the patient looks badly, is anaemic, has dyspnœa on exertion, frequency of micturition; especially useful when there is diarrhoea with tenesmus and albuminous urine. Use third decimal or higher. Searle, of Brooklyn, has advised Merc. cor. as the main remedy in acute nephritis, alternating it with Aconite or Ferrum phos., and in conjunction with warm baths (of temperature 98° to 100°) prolonged half an hour to one hour.

The remedy is suited to inflammations and acute congestion of the kidney. The urine is scanty or completely suppressed, very dark and contains albumin, blood corpuscles, granular and fatty casts. The late Dr. Millard used Merc. cor. in alternation with Cantharides for routine treatment in acute nephritis.

*Rhus tox.*—Suited to cases after the subsidence of the initial stages, when pain in the back is a feature, with general soreness or aching, but no dropsy. Useful in cases due to exposure and in some post-scarlatinal cases. Goodno uses the tincture in one-fourth drop doses hourly. Cowperthwaite uses the third decimal.

*Terebinthina.*—Fever, dyspnœa, headache and scanty, bloody urine. Dropsy may be absent, and, as a rule, uræmic symptoms are not marked. It is especially useful in acute nephritis from colds or malarial poisoning. The writer finds this the best general remedy for *hæmoglobinuria*, and uses the first decimal. Cowperthwaite advises the second decimal in acute nephritis.

*Veratrum viride.*—This is a remedy for the early stage of acute nephritis when congestion is the feature, high arterial tension, high temperature, or thin small pulse with troublesome vomiting. It is suited to the cerebral congestion and convulsions of the early stage, or during the course of acute nephritis.

Other remedies which may be indicated are *Phosphorus*,

#### SPECIAL THERAPEUTIC MEASURES IN ACUTE NEPHRITIS. 143

Digitalis, Bryonia, Cannabis Ind., Hepar, Secale, Sabina, Scilla, Chelidonium, Colchicum, Veratrum album, Antimonium tart., Nitric acid, Glonoin.

The writer uses Aconite, Belladonna, Cantharides, Terebinthina, Arsenicum and Ferrum usually progressively in the order named, when the case has a typical course.

**Special Therapeutic Measures.**—As a rule careful nursing and proper observance of hygienic and dietetic precautions are all that are needed in a case of acute nephritis, but symptomatic treatment should be employed with the hope of shortening the course and preventing the lapse into the chronic form. Vigorous measures, especially catharsis and active diuresis, are not advised so long as the case is doing well. Severe and dangerous symptoms may, however, require certain palliative measures which will be described as follows:

*Pain in the back* is sometimes severe in the onset of the disease and may possibly require cupping, *but only when severe*. Dry cups are used in the case of children, and wet in the case of adults. Warm poultices may also be applied to the region of the kidneys. In some cases counter-irritation may be necessary, as with mustard.

Internally Rhus tox., Oil of sandalwood, Pichi or Cantharides may be indicated. In severe cases of backache in acute nephritis from exposure the tincture of Rhus tox., ten drops in four ounces of water, teaspoonful hourly, is a favorite prescription.

*Dry skin and lack of perspiration* may aggravate the case; for this it may be necessary to use the hot air bath. In obstinate cases it may be necessary to start the perspiration with Jaborandi or Pilocarpine, and then promote it with hot packs or baths. In the case of children two to five grains of the second decimal trituration of Pilocarpine may be given every two hours until perspiration is established.

If the urine is suppressed more vigorous measures will be necessary. (See next paragraph.)

In some cases the Spirit of Mindererus, a solution of ammonium acetate, may cause diaphoresis when given in doses of half an ounce diluted with water. In cases where there is fever this remedy and Aconite may prevent the vaso-constriction which precedes uræmia. (Anders.)

Treatment of Uræmic Convulsions.—This varies according to the age of the patient and the severity of the convulsions. When the patient is a child and the urine is very scanty or suppressed and the uræmic symptoms, headache, vomiting, and twitchings forbode convulsions, the hot, wet pack should at once be used.

Tooker's method of giving the hot pack to young children with suppression of urine and uræmic symptoms is as follows:

Spread the bed with several layers of woollen blankets. While the child is being stripped, wring out a cotton sheet which has been immersed in a bucket of *boiling* water. Spread the sheet quickly on the open blankets and wrap up the child in it, leaving only head exposed. Bring over the blankets and tuck in all around as snugly as possible. Place a cloth wet in *cold* water on the child's head, and leave there. The pack should last from fifteen to twenty minutes to an hour; if the child goes to sleep, leave undisturbed until it awakes. When taken out, give a cool sponging.

In cases where there is great dyspnoëa or signs of cardiac weakness the hot air bath should not be used at all, but merely warm baths or a very short wet pack.

In cases where it is feasible *colon flushing with injection of normal salt solution*, as suggested by Dr. Wood, of Chicago, should be tried. A pint of warm, normal salt solution is injected, per rectum, after colon flushing, three or four times daily.

Hot linseed-meal poultices, containing a tablespoonful of mustard, may be applied to the region of the kidneys every four hours.

In desperate cases subcutaneous injections of a quart of

normal salt solution every six to twelve hours may be tried.

The principal drug in cases of uræmic convulsions is *Pilocarpine hydrochlorate*, use of which must be made with great care. The writer is fully aware that a good many large hypodermic doses of this agent have been given without apparent harm. At the same time it is well to bear in mind the fact that untoward accidents from administration of it are known to have occurred.

In the writer's opinion the dose and method of administration of the drug should be varied according to circumstances. In cases where the convulsions are severe and repeated it may be necessary to give a hypodermic dose of Pilocarpine as large as one-quarter of a grain, followed in twenty minutes by another. If, as a result, there are signs of cardiac depression a hypodermic of brandy or ether should be given at once, as suggested by Shattuck. Lastly the hot air bath should be administered to promote the perspiration caused by the Pilocarpine.

In the case of slight convulsions one-twelfth of a grain of the drug hypodermically, followed in three hours by another, and the hot air bath may be sufficient. If two hypodermics of one-twelfth do not start the perspiration two more may be given within the next eighteen hours. After the patient is conscious and has perspired freely tablets of the drug may be given by the mouth so that the patient takes in all one-twelfth of a grain a day for a few days.

When convulsions have not yet occurred, but are feared in consequence of marked uræmic symptoms (headache, vomiting and twitchings), Pilocarpine may be administered either as above or in the following manner:

Use the first decimal dilution, one teaspoonful in half a glass of water, of which mixture the dose is a teaspoonful every fifteen minutes until perspiration occurs, then every hour for forty-eight hours. Owing to its depressing action it is advisable to follow it with Digitalis tincture, fifteen minimis

in half a glass of water, of which the dose is a teaspoonful every hour until the heart's action is improved.

In the case of convulsions in children dry cupping of the loins, the wet pack and a brisk purgative may be all that is required without the use of Pilocarpine. In the case of adults, Chloroform, hypodermics of Pilocarpine, and in robust, red-faced or cyanotic patients venesection (withdrawal of twenty ounces of blood) are recommended, or colon flushings with injection of normal salt as above.

Inhalations of Amyl nitrite are sometimes serviceable in convulsions. Rectal enemas containing ten to twenty grains of Chloral Hydrate and twenty to sixty of Potassium Bromide may be used.

*For catharsis* in uræmia the most efficient agents are elaterium or croton oil, the latter in one-half drop doses, repeated every hour until the bowels are moved. The oil may be rubbed up with a small powder of sugar of milk and placed on the patient's tongue, even if he is unconscious. Oxygen inhalations, and sometimes caffeine hypodermically, may be of service in convulsions.

*The saline diuretics*, notably acetate and citrate of potassium, may sometimes be useful in acute nephritis. The writer has given the citrate in ten grain doses in water to young children and larger doses to adults. When the salines cause nausea they should be immediately discontinued. The acetate of potassium may be given in doses of sixty to ninety grains in twenty-four hours. Rectal injections containing this drug may be useful.

The treatment of drowsiness or coma is substantially the same as that of convulsions. These features sometimes yield to tepid baths, followed by cold showers.

In cases where cardiac weakness has been a feature before convulsions set in, Digitalis and the Acetate of Potassium must be our chief reliance.

**Cutaneous Ædema.**—This often requires no special treat-

ment, but if extensive or obstinate it may require methodical sweating, as by hot air baths or hot, wet packs.

Acute dropsy may, in addition to sweating, require hydrochlorate of Pilocarpine in hypodermic doses of one-sixth to one-third of a grain. But it should not be used if effect can be had from hot packs or hot air baths, as it may produce salivation or cause cardiac weakness.

Long-lasting dropsy, after subsidence of other features, sometimes occurs and this may require Digitalis or Theobromine (diuretin or agurin).

The fresh infusion of Digitalis may be used, one to four teaspoonfuls, according to age of the patient, three times daily; or agurin, a combination of Acetate of Sodium and Theobromine, which is preferable to diuretin, may be given. The dose of agurin for adults is fifteen grains in capsules four or five times daily; in the case of young children 2 to 5 years of age the dose should be two to five grains; those 6 to 10 may receive six to ten grains. Diuretin may be given in the same doses, but always dissolved in half a glass of water, and not in conjunction with acids.

In conjunction with the above a milk diet and the use of Epsom salt, one tablespoonful in sufficient water to dissolve it, one to three or occasionally four times daily.

In some cases one drachm of cream of tartar in a pint of lemonade increases the urine and thus removes the dropsy.

Care must be taken not to reduce the dropsy too suddenly for fear of uræmia. In acute nephritis Epsom salt sometimes produces vomiting and must be carefully administered.

In cases where the oedema is so extreme as to become a dangerous feature the skin may be punctured with a lancet or drained with a small silver canula. A fine aspirator needle may be used and the fluid allowed to drain through a piece of long narrow rubber tubing.

In some cases of extreme dyspnœa aspiration of hydrothorax and paracentesis abdominis may be necessary.

Colon flushings with rectal injections of normal salt solutions may be of service in the treatment of dropsy.

**Severe Vomiting.**—Vomiting or diarrhoea should not be interfered with unless severe, when it may require special treatment. Cracked ice may be given and Apomorphine or Cocaine in the second to fourth decimal trituration. Drop doses of Creosote, Iodine tincture and Carbolic acid have been recommended, also dilute Hydrocyanic acid with Bismuth. Hypodermics of Apomorphine, one-fiftieth of a grain, are said to have relieved cases. Mercurius dulcis may sometimes be of service but may cause stomatitis. Ammonia water (U. S. P.) in ten or fifteen drop doses largely diluted, or dilute Hydrochloric acid also well diluted, may be tried four times daily.

As a palliative the writer has used fluid extract of Ergot, four drops, Chloroform, five drops, in one teaspoonful of water, for adults; half this dose for children, followed by Jaborandi as above. These measures should be followed after relief by administration of Bismuth, Creosote, or Arsenite of Copper in the lower potencies.

**Inflammation of the Skin.**—This is due to the œdema and is sometimes a serious feature. Cataplasms of mercuric chloride 1:1000 or of aluminium acetate 1:100 may be applied. Antiphlogistine is also now extensively used in all such cases.

*Increased arterial tension* should be carefully attended to, as it may presage convulsions. The remedies are Aconite, Glonoin, Veratrum viride, Chloral hydrate.

**Acute Dilatation of the Heart.**—This dangerous complication is shown by irregular halting action of the heart, frequent, thready, fluttering pulse, cold extremities and frequent respirations, pulmonary œdema impending: the treatment is digitalis tincture four or five minims every three or four hours for a day or two, ceasing for a day or two, and beginning again; or digitalin  $\frac{1}{2}$   $\frac{1}{2}$  th of a grain instead; or strophanthus two to five minims of the tincture; caffeine one or

two grains, with one or two grains of sodium benzoate; strychnine  $\frac{1}{100}$ th grain, or even more, subcutaneously, hypodermics of camphor.

*For Signs of Collapse*, as alarmingly irregular, rapid breathing and cool extremities, tincture of strophanthus as above.

**Pulmonary œdema and Serous Inflammations.**—These, according to Kent, are to be treated by colon flushing and rectal injection of normal salt solution. The principal remedies are tartar emetic and arsenicum in pulmonary œdema, and bryonia, cantharides, scilla, senega, and mercurius cor., in serous inflammations. Inhalations of oxygen are sometimes serviceable if given early in these cases. Pulmonary œdema is a sign of cardiac weakness and not a part of the general œdema.

It may require application of large mustard plasters to the chest, baths, and acetate of lead, together with remedies already mentioned, for relief of the weak heart.

In the *pneumonia* of acute nephritis, therapeutic measures may prove futile; inhalations of oxygen, tepid baths, shower-baths, and wet packs have been tried, but usually without success.

*Anæmia*, following acute nephritis, requires ferrum as above, together with easily digested and nutritious food.

**Surgical Treatment.**—Harrison, in grave cases, when death is imminent or in cases which show no tendency to recover, relieves renal tension, if it is present, by a longitudinal incision along the convex surface of the kidney, one or two inches in length, inserts a drainage tube, and packs lightly with iodoform gauze.

#### THE ACUTE NEPHRITIS OF PREGNANCY.

**Definition.**—A peculiar renal change found only in pregnant women, cases of which are rare, and the nature of the disease disputed.

**Occurrence.**—The disease is a rare one, occurring in but one out of 250 to 300 cases of confinement and seven-eighths of the cases are said to be primiparae. Women who are illegitimately pregnant are said to be liable to it.

The statistics of the Philadelphia Board of Health (1868-1873) show the occurrence of eclampsia once in every 170 labors.

According to a writer in the *Medical Times* it seems that the negress is liable to eclampsia, and it appears to be becoming more frequent. It occurs before labor in the latter months of gestation. In ten years, from 1883 to 1893 (exclusive), 11,074 pregnancies (colored), deaths from eclampsia, 51; 6,054 pregnancies (white), 19 deaths. Lusk says it is reasonable to estimate that for every death there are two recoveries, and under this ruling we would have 151 cases in the 11,074 colored, and 9.4 cases per 1,000 white, which is more frequent than Galabian and Kleinwacher estimate for Europe (1:5000), and larger than Parvin's (1:3000) for this country. According to the Traube-Posenstein theory, "ahydremic condition of the blood" might be advanced, for the negro is becoming poorer each day, and this poverty means anaemia.

**Etiological Theories.**—Various theories have been advanced to explain the production of this disease; the principal ones are as follows: (*a*) That it is due to increased abdominal and pelvic pressure exerted especially upon the renal veins, upon the ureters, or upon the coeliac ganglion, thereby causing a reflex contraction of the renal arteries, and a consequent anaemia of the kidneys. (*b*) The parasitic theory, that it is due to bacterial infection. (*c*) The auto-intoxication theory, according to which the renal lesion is due to the elimination of excessive amounts of waste products coming from the maternal and the foetal organisms.

In spite of the modern tendency to believe in the theory of auto-intoxication, in which belief the writer joined for some years, it is by no means certain that this theory will account

for all the cases. The pressure theory still seems to hold good in certain cases. Modern treatment is based very largely on the theory of toxæmia, and most vigorous measures are resorted to in order to rid the blood of these substances.

Nevertheless Achard and Castaigne have shown that an eclamptic may eliminate methylene blue normally, while a case which eliminates the blue badly may present no evidences of eclampsia.

**Pathologic Anatomy.**—The kidneys are somewhat enlarged, pale and of a greenish-yellow color.

**Pathologic Histology.**—The principal changes occur in the epithelium of the glomeruli and the convoluted tubules, fatty degeneration, cloudy swelling, and in severe cases extensive necrosis are found. The last is usually not diffuse, but localized in the cortex in irregular areas. Fat embolism may occur in the capillaries of the glomerulus.

**Predisposition.**—In the author's experience women with history of convulsions during previous confinements, and primiparæ of neurotic family history are particularly liable to danger.

Lusk holds that when the disease occurs only in the later months, disappearing after labor even if eclampsia occur, it is not likely to return in subsequent pregnancies.

**Clinical Features.**—These are principally scanty urine, intense albuminuria and convulsions. Before these features are noticed there are usually others.

The disease probably begins early in pregnancy, manifesting itself then by the presence of a small amount of albumin and perhaps a few casts, but the latter may be absent. In the later months (seventh or eighth usually) three characteristic symptoms may appear before convulsions.

They are *headache*, *epigastric distress*, and *disturbances of vision*. The headache may be very severe and is often extremely so, but frequently it amounts to only a feeling of fullness and a moderate pain either frontal or temporal. The

epigastric symptom may amount to almost a crisis, so that it sometimes seems as if the stomach were eliminating some poison. Thus, one of Seabury Jones's patients who had convulsions after her second confinement suffered only from the former symptom in her first, but to such a degree that for several days no food at all could be administered. The sensation is at times one of most intense burning. The eye symptoms may amount only to a dimness or haziness of vision, or to complete loss of sight, or only to flashes of light.

Edema is also a clinical feature. It is most marked in the lower extremities, but appears also in the face and upper extremities.

Cases occur, however, in which eclampsia takes place before oedema or other features are noticeable, hence the importance of careful study of the urine.

Frequency of micturition is often noticed. Insomnia in a pregnant woman is always, according to Dr. C. T. Hood, to be regarded as a symptom suggestive of eclampsia. There is often nausea and even vomiting. It must be remembered that albuminuria may occur in from three to five per cent. of all pregnant women and not be followed by eclampsia.

In rare cases severe symptoms occur soon after conception, such as vomiting, headache, etc., and abortion may occur spontaneously. If it does not, the patient grows worse and the urine becomes very scanty ; unless abortion is produced there is practically no treatment of service.

[Some writers claim that there seems to be no relation between eclampsia and renal change, the former taking place without any signs of renal lesion and followed by albuminuria as if the latter were caused by the eclampsia. Malaise and headache, however, may precede the convulsions. Cazeaux claims in opposition to this that it has never been conclusively proven that eclampsia has occurred in a case where albumin has been absent from the urine *continuously* for a considerable length of time preceding such accident. The writer's experience thus far is in accord with Cazeaux.]

The urine is usually diminished in quantity, very considerably just before convulsions, is of high specific gravity, contains a large amount of albumin, and is remarkable for the small quantity or even absence of tube casts. If present, the latter are usually small hyaline ones. Blood is rarely present.

The writer's experience with this class of cases is as follows: In the earlier months the urine is of light color, somewhat diminished in quantity and specific gravity. The urea is 6 or 8 grains per fluidounce, and albumin from a trace to one or two per cent. bulk. A hyaline cast or two may be found at times. In later months the character of the urine may change *gradually or suddenly*, in some cases certainly in as short a time as a week, how much sooner it is difficult to say. It becomes scanty, much darker in color, of high specific gravity, urea increases in grains per fluidounce possibly up to sixteen, and the percentage of albumin undergoes a remarkable increase until the urine is loaded with it. At this time casts may be absent and are always hard to find. But in a short time from the occurrence of the sudden change in the general character of the urine convulsions occur. The writer has as yet not seen any cases in which the convulsions were not preceded by this change in the character of the urine, and in several cases has been able to predict eclampsia twenty-four to forty-eight hours before it occurred. Careful distinction must be made, however, between the nephritis of pregnancy and pregnancy occurring in nephritic women. In the latter class of cases the writer has seen thus far but one case of convulsions, that of a woman who died from convulsions a few months after confinement, although she recovered from convulsions at the time of confinement.

In the acute nephritis of pregnancy too much reliance must not be placed on the absence of casts. In one of the most rapidly fatal cases the writer has seen only one or two small hyaline casts could be found in the urine two days before death. Dr. H. M. Bascom, of Ottawa, reports ten cases, one

occurring early, the rest later during pregnancy. In none of these cases were casts found. Nine had eclampsia. Seven were fatal.

**Onset of Eclampsia.**—About one-half of the cases of puerperal eclampsia occur during labor, in the rest it occurs either before or after delivery. It may take place as early as the third month of gestation.

Symptoms of approaching convulsions: Rolling of the eyes, spasmodic twitching of the face; as the convulsion proceeds the eyes turn back, the tongue may or may not protrude; respiration is interfered with, and the woman's face becomes turgid with blood.

Eclampsia may begin either with mild prodromal symptoms or suddenly with violent general convulsions, during which the child is born. A more or less persistent coma follows the convulsions.

**The Condition During Eclampsia.**—Eclampsia usually begins with a short tonic stage, during which the whole body is generally in a position of extension in opisthotonus, following which there are vigorous clonic contractions in the face and extremities. The face becomes cyanotic, there is bloody froth on the mouth, the pupils are usually dilated and almost without reaction, the respirations are accelerated, at times intermittent from spasm of the respiratory muscles; the pulse is small and accelerated, scarcely felt in the radial artery, and the temperature is sometimes elevated.

In some cases the spasm begins with short, jerky contractions in one extremity, as in an arm, and then invades the muscles, face and legs. It may happen that one-half of the body is more affected in the attacks than the other. The spasms usually cease in a few minutes, and are followed by deep coma and stertor lasting several hours or more. The spasms are likely to be repeated. As many as twenty may take place in the twenty-four hours, during the whole of which there may be complete loss of consciousness. Severe

and fully developed epileptiform attacks may alternate with slighter convulsions. After recovery there is amaurosis for a day or two.

**Duration.**—In favorable cases there is rapid recovery after the birth of the child. Chronic nephritis following the disorder is rare, but a slight albuminuria may persist for months.

**Causes of Death.**—The patient may die from exhaustion, caused by the rapidity with which the convulsions come on. In the violent form she may die from apoplexy, caused by pressure upon the jugular vein ; she may die from asphyxia, the result of spasm of the glottis ; pulmonary and cardiac serous effusion; effusion upon the brain, coma, cerebral congestion ; spasm of the heart ; of the last they die instantaneously.

Children die from violent pressure exerted by the womb and abdominal muscles, or they may die from toxæmia.

The mortality is 30 per cent. in the mother and 50 per cent. in the child.

**Convulsions Not Uræmic.**—These may be due to the following causes :

A rigid, contracted cervix uteri ; small pelvis through which the child makes slow progress under heavy pressure ; severe, prolonged, ineffective pains, and the unyielding perineum ; these are frequent causes of convulsions of the less serious kind.

A woman may have hysterical fits in childbirth ; she may have epilepsy. In rare cases alcoholic poisoning has produced convulsions. (*American Practitioner.*)

#### TREATMENT OF THE NEPHRITIS OF PREGNANCY.

Wright holds that the best diet is the following :

Milk, buttermilk, koumiss, as much as the patients care to drink, no more ; plain water in abundance ; tea once a day, if desired ; cocoa, lemonade, mineral waters, etc.; stale bread and butter ; dry or cold toast and butter ; rice, tapioca, arrow-root ; fish without rich gravy ; limited amount of white meat

and raw oysters; limited amount of salt; vegetables of all sorts, restricting the supply of potatoes, and encouraging the use of greens, such as lettuce, spinach, water-cress, etc.; ripe fruits, such as oranges, bananas and grapes; other fruits cooked, such as apples, pears and peaches; mineral waters, especially Hunyadi Janos, or a mixture of Friedrichshall and Carlsbad; milk diluted with such waters as so-called soda-water or Apollinaris or Sprudel or Vichy. Patients are not allowed to take both milk and fish or meat at the same meal. In a limited number of cases, eggs, beef, mutton, and bacon are allowed; but where the poison appears to injure the kidneys, especially with profuse albuminuria, prohibit meats of all sorts, eggs, cheese and oysters, and put the patient on a diet largely composed of diluted milk and vegetables.

This diet of Wright's is based on the toxæmic theory that the liver and intestines are at fault.

When the urine is scanty the writer suggests the use of White Rock lithia water as a beverage.

Milk diet for a long period is not desirable, and in the case of plethoric women not allowable.

When convulsions are impending it is customary to put the patient on a rigid milk diet; woollens are worn next to the skin, and a frequent warm bath is given at a temperature of from 100° to 105° F., for three to ten minutes, followed by brisk rubbing. In some cases where the skin is inactive hot packs are better than hot tub or vapor baths, and, according to Powelson, safer. The bowels should be caused to move freely and the patient should drink freely of water.

**Preventive Treatment.**—The method of Dr. Walter Wesselhoeft is as follows:

The patient, wholly nude, is wrapped in a sheet which has been wrung out, not too dry, in tepid water. Over this a blanket is wrapped, the arms being kept inside, yet with a care not to impede respiration too much. A coverlet is then thrown over the patient, and she is left for about three hours

thus, at the same time giving her plenty of carbonated beverages and milk. This measure is repeated twice a day.

Ahlfeld, of Marburg, who has lately been using this method, reports that out of thirty-six patients, of which twenty-three were primiparæ, with oedema and albuminuria more or less pronounced, where this treatment was employed, none had eclampsia. Besides, he had one patient who, after two successive miscarriages with albuminuric retinitis during her first two pregnancies, was able to go on to full term during the third with the help of these wet packs.

**Symptomatic Treatment.**—Inasmuch as the pathology of this disorder is practically unknown, symptomatic treatment assumes importance.

*Aconite*.—Useful in the premonitory symptoms of eclampsia in plethoric women, especially those who are primiparæ. Symptoms as in acute nephritis.

*Argentum nitricum*.—Constant fever and expectation of the approaching spasm.

Exceeding restlessness, exceedingly violent spasms.

*Arnica*.—Full, strong pulse in premonitory stage; blood rushes to the head but body remains cool or of normal temperature.

*Belladonna*.—When the spasms are fully developed, eyes red, congested and stare rigidly. There may be paralysis of the right side of the tongue and difficult deglutition; bloody froth in the mouth and on the lips.

*Arsenite of Copper*.—Useful in convulsions occurring in a woman with chronic nephritis, and whose heart is affected by the disease. The urine has an odor of garlic. The writer believes that gastro-intestinal symptoms preceding convulsions call for this remedy.

*Gelsemium*.—Symptoms simulate incipient typhoid. The head feels very large, the patient is irritable, sensitive and in nervous dread of approach of labor.

*Helonias*.—Drowsiness and marked weakness, with tendency to colic, which passes away during employment.

*Hyoscyamus*.—Bluish color of the face, twitching and sub-sultus tendinum marked with almost constant delirium.

*Mercurius cor.*.—The urine is scanty, with frequency of urination at night, and yellowish tint to the skin.

*Opium*.—In convulsions due to suppression of labor pains; constant stertorous respiration, both on inhalation and exhalation, with stupor, half closed eyes, etc.

*Stramonium*.—Much fear and shrinking, followed by spasms.

*Terebinth*.—In rare cases when the urine contains blood.

*Uranium nitrate*.—Rising at night to urinate, and passage of hyper-acid urine; in ill-tempered, despondent patients; abnormal mammary development and hyper-secretion of milk.

*Mercurius cor.* and *Helonias* are used in diametrically opposite conditions; the former when the urine is scanty, the latter when clear, light-colored and profuse. *Apis* has scanty urine like *Mercurius*, but oedema of the face and extremities is marked. *Arsenicum* when numbness, prostration, anaemia and dropsy are features.

*Glonoin* is suited to congestive headaches, pulsations, quick throbbing, frequent desire at night to urinate, and rush of blood to the head. The writer, however, finds that *Aconite* is more reliable for precisely these symptoms than *Glonoin*. *Apocynum* is indicated in dropsical conditions, slowly-acting kidneys, with weakness, depression, drowsiness and labored action of the heart. If too large doses irritate the stomach, administer liquid pepsin after it, as in case of diuretin. *Lachesis* is indicated in dropsical conditions associated with albuminuria, where oedematous tissues are dark; when the urine is dark and albuminous and the symptoms are worse after sleeping.

*Jaborandi*, or its alkaloid, *Pilocarpine*, is given as a routine measure in doses of  $\frac{1}{6}$  to  $\frac{1}{3}$  of a grain, hypodermically, once weekly after albumin appears until no longer necessary. It should not be given unless respiration and heart are normal.

*Uranium nitrate* is said to be valuable the more closely the symptoms resemble diabetes mellitus. (See above.)

*Chloral hydrate* may be used in routine treatment; fifteen grains are dissolved in water and added to six fluidounces of simple syrup; a teaspoonful is given every four hours when uræmia is threatening, as suggested by Dr. Kinyon, of Ann Arbor.

**Palliative Treatment.**—*Diastase*, lactopeptine, caroid and similar agents may be of service in the gastric disturbances.

*Potassium or Lithium citrate* is serviceable when the urine is scanty. Hood uses the following powder three times daily :

B Apis, first decimal trit., . . . . . gr. x.  
Lithium citrate, . . . . . gr. i.

*Senna*.—According to Hood this is the best thing for the sluggish bowels of a pregnant woman. Take one ounce of fresh senna leaves and one-half ounce of fennel seed with one-fourth ounce of solid extract of licorice. Steep these over a slow fire for several hours, making of this twelve to sixteen ounces of liquid after it is strained. Add four ounces of sugar. Of this she should take one to three teaspoonfuls at night.

*Arsenite of Copper* may be given the patient to prevent the return of convulsions. Use the second decimal trituration.

*Digitalis*.—This remedy may be given internally or in the form of foxglove poultices, applied to the lumbar region, when the urine is scanty, to promote diuresis.

*Veratrum viride*.—Cases in which there is a full bounding pulse, suffused face, convulsions, patient returning to consciousness between convulsions. It reduces the temperature, relaxes the cervix, and causes prompt diaphoresis and diuresis. Dose, 5 to 10 minimis of Norwood's tincture every 20 or 30 minutes until the pulse falls to sixty or below.

#### SPECIAL THERAPEUTIC MEASURES.

When uræmia threatens, the patient should be caused to

have ten or twelve watery movements of the bowels for a day or two and subsequently four movements daily every day by means of administration of Epsom salt. Not less than two evacuations a day should be allowed until after labor.

*During convulsions* Hood gives Norwood's tincture of *Veratrum viride*, if the pulse is over 80, in doses of 10 to 15 minims hypodermically. The colon and rectum are emptied and the colon filled with normal salt solution; if it is not retained, intravenous transfusion is performed. If the pulse does not fall to 80 in thirty minutes the dose of *Veratrum* is repeated, and again in an hour. A pint or two of blood is withdrawn and one-third more salt solution than blood injected. Chloroform by inhalation is given until the patient is able to swallow, when four grains of *Calomel* and five of *Sodium Bicarbonate* are given, and the same repeated in two hours; in four hours a saline cathartic is given. If sweating is necessary, the hot pack is preferable to the hot tub bath.

If induction of labor is necessary, the patient should be thoroughly purged by the use of Epsom salt, and sweated by means of the hot pack before the operation is performed.

*For weakness of the pulse* Powelson advises oxygen gas, whisky and Digitalis.

*For the distention of the bowels* after recovery from convulsions Epsom salt and glycerine enemas.

*For coma and suppression of urine* after convulsions *Arsenite of Copper* second decimal trituration, *Digitalis* tincture and foxglove poultices over the lumbar region.

## CHAPTER VIII.

### CHRONIC NEPHRITIS.

The principal characteristic of chronic nephritis pathologically is *a productive inflammation of the interstitial tissue or stroma*. For this reason the term parenchymatous or tubal is inapplicable to chronic nephritis ; while epithelial changes may in some cases overshadow the interstitial inflammation, nevertheless the latter always exists, hence the necessity for use of the term *diffuse*. Clinically speaking, cases of nephritis which last six months or more are assumed to be chronic rather than acute. On the other hand, and in the majority of cases of some chronic forms, the disease is insidiously chronic from the onset without ever having been acute.

Pathologically, it is impossible to draw a sharp line between acute and chronic nephritis, since the alterations in the latter are only an intensification of the processes characteristic of the former. (Riesman.)

We classify chronic nephritis chiefly according as the kidney is softer or harder than normal. That type in which the consistence of the kidney is *decreased* receives the name of *chronic diffuse nephritis without induration* ; that in which the consistence is *increased* is given the name of *chronic diffuse nephritis with induration*. This classification is, on the whole, more satisfactory than one based on the size of the kidney, for the reason that kidneys larger than normal may be totally different in their pathological changes.

#### CHRONIC DIFFUSE NEPHRITIS WITHOUT INDURATION.

##### (CHRONIC NON-INDURATIVE NEPHRITIS.)

**Definition.**—A form of chronic diffuse nephritis in which the new cells of the stroma do not proceed to form mature

connective tissue, hence absence of scar-tissue, of contraction, and of hardening or induration, except in advanced cases, where more or less fibrous tissue formation may be found in limited areas.

**Synonyms.** — Bright's disease, second stage; chronic croupous nephritis; chronic tubular nephritis; large white kidney; fatty kidney; chronic parenchymatous nephritis.

*Note.*—This is the disease discovered by Dr. Bright, hence sometimes called "the Bright's disease of Bright."

**Etiology.**—The causes are as follows:

1. Most commonly it arises obscurely and insidiously from unknown causes; possibly due to elimination of micro-organisms in the course of acute infectious disorders, especially the pyogenic cocci and the bacillus coli communis.

Among the supposed causes are the following:

Malaria, syphilis, exposure to cold and wet, *alcoholism* and chronic heart diseases.

Diseases of the lower urinary tract, especially calculous disorders, purulent cystitis, stricture of the urethra and prostatitis. It may accompany malignant neoplasms, and the latter escape recognition in consequence.

It occurs in the course of chronic anaemia; especially in that due to phthisis, cancer, gastric ulcer and in pernicious anaemia.

It is associated with amyloid degeneration of various organs, and perhaps is due to the causes of amyloid disease. (See AMYLOID KIDNEY.)

2. In rare cases it is the result of acute nephritis, especially (*a*) post-scarlatinal, (*b*) idiopathic, (*c*) that of pregnancy, (*d*) that of malaria, and (*e*) that of exposure to cold.

3. Metabolic poisons elaborated in the digestive tract or in the interior of organs or muscles may be presumed to be a factor in the causation.

It is said that irritation of the renal epithelium by excretion of tubercular toxins may produce this form of nephritis.

**Occurrence.**—Most often in men between twenty and forty. The writer finds it especially common in men who have led what is known as a "hard life," that of poverty, exposure and drink.

It may, however, occur in children and women.

In the writer's experience several cases of it have occurred in anaemic young women.

According to Edebohls it may be unilateral in one-half the cases.

**Pathologic Anatomy.**—*The Kidneys.*—Large, flaccid, doughy. As a rule, larger than normal, sometimes double normal in size. The larger the softer, and in general usually softer than normal. The color, yellow or red, according to the amount of fat or of blood. Pale color is common.

*The Capsule.*—Taut but easily stripped.

*The Surface.*—Smooth, grayish-yellow or yellow, sometimes mottled with white and deep yellow patches. Has an oily feel, and oil drops are seen on the section-knife.

*The Superficial Veins.*—Conspicuous.

*Section.*—The cortex wider than normal, of yellowish or mottled color, the medullary rays of grayish translucent appearance; the pyramids usually darker than cortex, sometimes uniformly yellow with it.

There are three kinds of kidneys according to color, the large red, the large white or yellow, and the large mottled.

When the yellow color predominates, the kidney is known as the *large white or yellow kidney* (Fig. 14), synonymous with what has been called *chronic parenchymatous nephritis*. The color where yellow sometimes resembles that of butter. The pale color is due to fatty changes and to anaemia.

In case of necrosis of the entire kidney the latter diminishes in size and becomes softer than normal, and of a dirty-yellow color.

Congestion and haemorrhages may modify the appearance of the kidney to such an extent that its size is merely normal

or only slightly larger and its consistence even somewhat increased. On the surface, in such cases, grayish or yellowish areas alternate with reddish ones, producing a variegated appearance. This condition is known as *chronic hæmorrhagic nephritis* or *the large mottled kidney*.

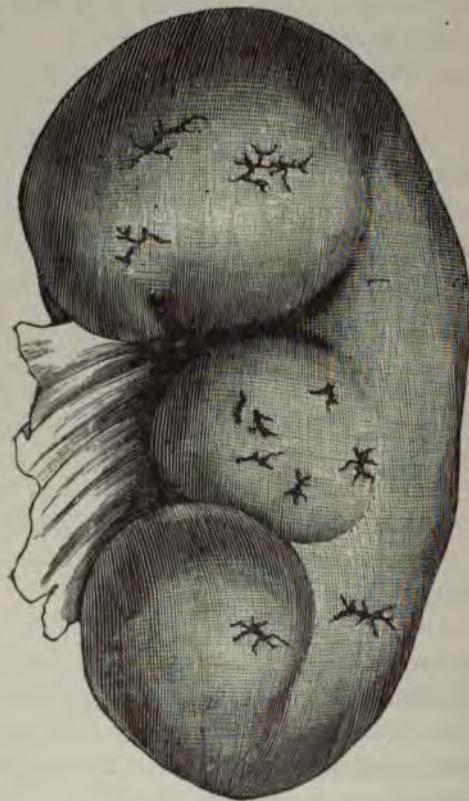


FIG. 14. Large white kidney showing commencing retrogression.—(RALFE).

On section the cortex is found widened and marked with reddish striae or reddish patches of haemorrhage. In this kidney the capsule may be adherent in places.

**Pathologic Histology.**—The principal characteristic is fatty change in the epithelium. Changes in the *glomeruli* are

always present and are both degenerative and proliferative. In a large number of cases the glomerular changes are far more marked than the tubular, hence the term *chronic glomerulo-nephritis*.

The degenerative changes may cause almost complete disintegration of the affected glomeruli.

The proliferative changes may result in highly cellular glomeruli.

Change in the *tubules* is common and affects especially the epithelium of the convoluted tubules with fatty degeneration; in advanced cases the epithelium of the straight tubules may also be involved. Usually not all the cortical tubules are affected, the degeneration tending to be focal in character.

Changes in the *interstitial tissue* are ordinarily not very marked. They consist in oedema and small foci of round-cell infiltration about the glomeruli and veins.

In the *haemorrhagic* cases we find the following: (a) *In the glomeruli* an abundant exudate of blood into the capsular spaces; (b) *in the tubules* abundance of red blood corpuscles, which may be distinct and separate or fused into homogeneous colloid masses, with altered blood pigment in the epithelial cells; (c) *in the interstitial tissue* presence of altered blood pigment and fat granules; there is a more marked tendency toward production of new fibrous tissue.

In these cases fatty changes are less pronounced.

**Onset.**—The patient at first is pale and out-of-sorts, loses his appetite, and may become easily nauseated, have a gastro-intestinal crisis or headache. Oedema then appears, and is usually the first thing to attract attention to the kidneys.

**Diagnosis.**—Dropsy, anaemia, together with albuminous urine containing abundant sediment, are the cardinal features. There may also be headache, nausea and vomiting.

**Clinical Features.**—*Dropsy.*—First puffiness of the eyelids in the morning, swelling of ankles and feet toward night; later progressive, obstinate and general throughout the whole

subcutaneous tissue; eventually extreme, and ultimately involving serous cavities, lungs and brain.

It may persist even when violent diarrhoea is present, or when there is an abundant flow of urine. In rare cases there is no oedema but periodic renal haemorrhages (*chronic haemorrhagic nephritis without dropsy*).

The more severe and comparatively acute the case the greater the dropsy.

Dropsy is found in the beginning of the cases; its course may be either slow or rapid until it is of great intensity, and it may persist for months.

In some cases oedema of the glottis is found.

*Anæmia*.—Face pale, puffy; mucous surfaces pale; extremities and body dough-like. In very chronic cases less anæmia.

*Debility*.—Progressive. Patient feeble, helpless, finally bed-ridden.

*Emaciation*.—Also progressive, but masked by dropsy.

*Digestive Disturbances*.—In the beginning loss of appetite and morning nausea; later vomiting before breakfast, diarrhoea. Diarrhoea is, however, not so prominent as in amyloid kidney. *Loss of appetite is very common*. Constipation is more common than diarrhoea. In severe cases in the last stage there may be dysentery and intestinal ulceration.

*Condition of the Heart*.—There is often hypertrophy of the left ventricle with or without dilatation, and in some cases of the right. Dropsy may interfere with the examination of the heart, but the abnormally tense pulse, accentuation of the aortic second sound and displacement of the apex outward, or at least increased strength of beat will be noticed. Endocarditis and pericarditis are rare.

*The Pulse*.—The tension increases, and the arteries gradually become stiff, or the left ventricle becomes hypertrophied.

*Uræmic symptoms* in the disease are more commonly those of chronic rather than of acute uræmia, namely, stupor, slight

vertigo, expression of suffering, headache, cutaneous pruritus frequent vomiting before or after meals, or when fasting, serious dyspepsia, diarrhoea, and especially asthmatic troubles.

Convulsions have been known to follow disappearance of dropsy after hot bath.

According to Southey, out of 106 cases with dropsy only thirty-eight had uræmia, or 35 per cent. Fürbringer's experience is that only 17 per cent. had uræmia.

Uræmia may occur at any time, but not usually in full development, and is somewhat rarer than in chronic interstitial nephritis.

*Miscellaneous.*—Headache and wakefulness; vaso-motor affections resulting in hyperæsthesia and paræsthesia ("dead finger," itching, burning, etc.) may be the earliest symptoms of the disease.

*Habitual abortion* (premature loosening of placenta, formation of white nodules) has been observed.

The ear is frequently affected in this disorder—otitis interna, pains and noises without evident cause, sudden deafness from labyrinthine affection, remarkable changes in the hearing, etc., are noticed.

In rare cases the symptoms are those of *cholera nostrorum*, or *genuine dysentery*, masking other symptoms, save dropsy and albuminuria.

*Abortive forms* may exist without symptoms other than granular casts and renal epithelia in the urine; or there may be the usual dropsy, anaemia, chronic dyspepsia, etc. The patients are usually alcoholics, and the disorders may remain stationary or even be partially cured (slight nephritis with circumscribed lesions).

*Striking remissions* and intermissions are frequently seen, with disappearance for a time of albumin, casts and dropsy, and increase of strength.

As to *inflammations of serous membranes*, pleurisy is most common, peritonitis next and pericarditis third.

*Affections of the liver and spleen* occur, as hepatitis, nutmeg liver, lipomatosis hepatis, acute and chronic tumors of the spleen.

*Violent renal haemorrhages* should not be held to indicate an acute rather than a chronic lesion.

*Retinitis* occurs in some cases.

Forms of *bronchitis* and *pneumonia* occur as in the acute nephritis. Recurring attacks of bronchitis are of frequent occurrence.

In all cases of nephritis the physician should be on the alert for signs of *pericarditis*.

Gatchell says: "One of the signs to be found at this early period is in the third left intercostal space. Sometimes, for one or two days preceding the appearance of the friction-sound, there can be detected in this space diminished respiratory action. It later extends to the second interspace. Another early sign is a peculiar loud metallic character of the pulmonary second-sound.

"The two signs described belong to the premonitory stage of the disease. After the inflammation has become established other signs, some of which are of a more positive character, follow. The to-and-fro friction sound, when detected, is of diagnostic importance. Sometimes it is transient, and so may be lost. When there is effusion, even though it may be moderate in amount, the most important sign is the one to which attention was called by Rotch. This is the appearance of dullness in the cardio-hepatic angle, which is in the fifth right interspace, adjacent to the edge of the sternum. Normally, there is dullness at the cardio-hepatic angle, due to the deep dullness of the liver. But when there is fluid in the lower right sulcus of the pericardial sac the percussion note in this space is of much higher pitch, amounting even to absolute flatness. This is an important diagnostic sign when there is small amount of effusion.

"Other important diagnostic signs are the detection of the

apex-beat inside the left line of dullness, and also a full, strong pulse with enlarged area of precordial dullness, cardiac hypertrophy being excluded.

"There is another sign concerning which our views must be altered. Tradition says that with copious effusion the heart may be displaced upward and to the left so that the apex-beat may give evidence of being as high as the third interspace. But tradition is wrong. The pulsations occurring in this space are caused by the action of the right ventricle, and not by the apex."

*The Urine.*—*Quantity.*—About half normal, or less than two pints, with marked fluctuations. Night urine, on average, equals, or more often exceeds, day.

*Specific Gravity.*—Usually below 1.020; sometimes higher.

*Appearance.*—Opaque, hazy, dirty.

*Color.*—Runs from pale to dark-red, according to quantity of urine.

*Reaction.*—Acid.

*Albumin.*—Abundant. Seldom less than 3 to 5 in Esbach tube, and often enormous, one to five per cent. by weight, 50 per cent. or much more by bulk, practically filling the whole tube when coagulated. Percentage increases with the specific gravity.

*Urea.*—Diminished, usually both relatively and absolutely. Seldom normal or above normal per 24 hours, except when dropsy subsides.

*Chlorides.*—Diminished.

*Phosphates.*—Usually diminished in ratio to urea.

*Sediment.*—Milky, abundant; remarkable for variety and number of constituents; all sorts of casts, various in length and breadth; broad hyaline, dark granular and fatty the characteristic casts. Granular masses numerous; numerous pus corpuscles, disorganized renal epithelia, fat drops, fat crystals, small shreds of connective tissue. Few blood corpuscles except during acute recurrences, or in haemorrhagic cases in

which blood coloring matter and corpuscles are both present. It is of importance to notice whether blood is present, visible to the naked eye, in order to distinguish the chronic haemorrhagic cases.

A large amount of liquid ingested may not greatly increase the quantity of urine.

In extreme cases, when the urine is less than ten fluid-ounces for twenty-four hours, an enormous quantity of albumen (nearly 5 per cent. by weight) and high specific gravity—1.045 to 1.050—have been noted.

The writer has frequently found the total urea for twenty-four hours but little decreased. Before death, however, in the same cases, a marked decrease took place.

**Duration.**—Subacute cases last from three to six months; the very chronic cases may last two or three years by transition into secondary chronic interstitial nephritis.

Cases which begin more acutely last about three months; those which begin gradually, much longer—a year or more.

In severe cases death from dropsy or uræmia takes place in from three months to a year. Dangerously severe attacks of acute nephritis may occur in the course of the disease and render the prognosis unfavorable.

**Prognosis.**—Recovery is possible when the disease is limited to a portion of the kidney, and this explains the unexpected recoveries which we often see. Long continued dropsy with scanty urine are unfavorable signs. Sudden increase in œdema or onset of severe uræmia unfavorable. Milder forms may terminate favorably for the time, but develop into severe nephritis frequently.

Incomplete recovery may take place, *i. e.*, a long pause, with almost entire disappearance of albumin and dropsy. Large quantities of albumin, prolonged decrease in the twenty-four hours' quantity of urine, and increase in the pus corpuscles of the sediment are said to be unfavorable signs, but remissions may take place even under such circumstances.

Most writers hold that casts, however numerous, do not have much influence on the prognosis, yet the author has seldom observed recovery in cases where the long, dark, granular casts are numerous. While complete cures are exceptional, even the most serious cases can sometimes be cured, especially if of malarial or syphilitic origin.

In a large number of cases observed by the writer during seven years, 42 per cent. were dead at the end of that time.

McNutt says as many as 50 per cent. of the cases recover.

If the disease lasts beyond a year, the prognosis becomes, according to Purdy, increasingly gloomy. The longer after six months it lasts the less likely is recovery.

The disease frequently spares weak patients but carries off vigorous ones.

Fürbringer mentions the case of a patient who had remained weeks in uræmic coma, and from whom over fifty quarts of fluid had been drawn by puncture, who nevertheless recovered sufficiently to go about the hospital gardens, the kidneys having gone on to the stage of contraction.

Cases due to malaria, syphilis, or surgical processes may be treated successfully.

After the transition to secondary chronic interstitial nephritis recovery may be simulated for a time, but eventually the patient manifests uræmic phenomena.

Cases which have lasted a year or more almost never recover. (Anders.)

**Dangers.**—Emaciation and exhaustion from dropsy and hydramic conditions of the blood. Cœdema of the lungs or larynx. Intercurrent acute inflammations of the lungs or serous cavities, as pleurisy, pneumonia ; or erysipelas.

In some cases uræmia becomes a dangerous feature, but not so commonly as in other forms of chronic nephritis.

#### CHRONIC HÆMORRHAGIC NEPHRITIS WITHOUT CÆDEMA.

This disorder is somewhat rare, but should be carefully distinguished. There is usually history of some suppurative

process, septic infection or toxæmia. The clinical features are confined almost wholly to the urine. Uræmia is rare, and there is no cardiac hypertrophy. The writer has noticed, however, in one case marked accentuation of the aortic second-sound.

*The urine* contains always more or less blood, a little albumin and hyaline casts, the latter frequently containing red blood corpuscles or haematoïdin granules. The course is slow and recovery uncertain. It has been noticed that apparent recovery is usually followed by a sudden haemorrhage. The termination is probably secondary chronic interstitial nephritis.

In one case of this kind which the writer now has under treatment the patient is to all appearances well and feels well. The urine contained at first a few per cent. by bulk of albumin, together with red blood corpuscles and a few casts. Careful diet and small doses of Strychnine phosphate reduced the albumin to a trace, but blood corpuscles are found every time the urine is examined.

**Differential Diagnosis.**—The different forms of chronic diffuse nephritis without induration should be carefully distinguished.

LARGE MOTTLED KIDNEY.

History of alcoholism.	LARGE WHITE KIDNEY.
Dropsy not of high degree, or may be absent.	Dropsy marked, of high degree.
Cardiac hypertrophy and retinitis.	Cardiac hypertrophy very common.
Uræmia quite frequent.	Uræmia frequent.
Urine persistently rich in red blood corpuscles and casts.	Urine contains but little or no blood.
Duration commonly six to eighteen months.	Duration may be six to eighteen months, but is usually shorter.

Chronic non-indurative nephritis is distinguished from acute nephritis by the age, history and duration of the case. In adults acute nephritis, except that of pregnancy, is rare. History of an acute infectious disease points to acute nephritis.

When the tube-casts are in the main dark granular, fatty or waxy the case is most likely chronic, no matter what the age or history is.

Chronic non-indurative nephritis is distinguished from chronic (passive) hyperæmia by the abundance of albumin and casts, and the usual absence of mitral lesions.

Chronic non-indurative nephritis is distinguished from chronic primary interstitial nephritis by the presence of œdema early, and by the large amount of albumin and the number and variety of casts.

Chronic non-indurative nephritis is distinguished from amyloid kidney by the absence of history of suppurative processes and of enlarged liver and spleen.

#### TREATMENT OF CHRONIC DIFFUSE NEPHRITIS WITHOUT INDURATION.

**General Treatment.**—Greatest care in avoiding chilling of the surface. Removal from proximity to large bodies of cold water like the Northern oceans, seas and lakes. Continuous residence in warm, equable climate. When change of climate is not possible, heavy woolen underclothing is to be worn day and night. Habitual free ingestion of liquids to promote perspiration.

During the winter patients should be kept in a warm, well-ventilated room, and in recumbent position as much as possible. The temperature should be about 75° F.

Women must stay in bed, or at least in a recumbent position, during the menstrual period.

All over-exertion to be avoided. This is a relative term: comparatively slight exertion may be over-exertion to some patients. Sexual intercourse, use of alcoholic drinks, tobacco, etc., are in the same category.

The writer believes that if patients would go to bed and stay there for a long period of time the percentage of recoveries would be greater.

**Bathing**—From ten minutes to half an hour every one to three days in water, temperature of which is gradually raised to 105° F. Rubbing, massage, and wrapping in blankets afterwards, but excessive sweating to be avoided. Best taken at night.

Robust patients may take vapor baths preferably, with stay, when possible, in apartments where bath is given, until next day; such baths to be taken daily, or once in three or four days, according to strength. If uræmia threatens, twice daily.

The question of bathing is an important one. Powelson advocates the use of the *hot pack* in preference to the hot tub bath. He mentions the case of a young girl who bore a number of hot packs well, but immediately went into coma and died after being put into a hot tub bath. The writer saw a case in an elderly man where the hot air bath immediately produced unconsciousness and death on the following day.

The writer thinks favorably of *mud-baths* in the treatment of chronic nephritis, used of course in conjunction with other means. The feature of the mud-bath, which commends itself, is the evenness of the temperature and the absence of chill.

For residents of the Middle West the mud-baths at Kramer, Indiana, near Attica, on the Wabash railroad and Chicago and Eastern Illinois, are convenient and the hotel comfortable.

**Diet in the Less Severe Cases.**—The patient may take the following:

1. What he does take frequently, but little at a time.

Soups: Vegetable, sago or vermicelli.

2. Oysters (raw only) and fresh fish, which should not be fried. Shell-fish in general, if fish is not well borne.

3. Meats: Tender beefsteak and mutton chops once a day, but not in very severe chronic cases. The fat portions of steaks and chops to be preferred. White meat of poultry. Chopped beef.

4. Vegetables: Green vegetables, except beans and peas; vegetable salads.

5. Farinaceous food: In general, properly-cooked farinaceous foods are allowed. Well-risen bread, toasted stale bread, well-cooked rice, tapioca, arrowroot, etc., bread and milk. Battle Creek Foods.

6. Desserts: Rice pudding, milk pudding, tapioca pudding. Fruits: Those which are laxative and those not too acid, as ripe peaches, pears and especially grapes. Iceland moss jelly.

In some cases where the symptoms are not urgent, fruit, as, for example, an orange first at breakfast, followed by oatmeal and cream, are advisable. At the noon meal, tender steak, or chops; at night, skim milk and "zwieback."

7. Drinks: *Distilled water*, flavored with lemon juice; such mineral waters as are almost free from solids.

A small amount of light wines may sometimes be allowed those who are in the habit of taking alcoholic drinks. Butter-milk is an excellent drink for those who like it.

**Articles to be Avoided.**—The patient should avoid the following:

1. Overloading the stomach; all animal soups.

2. Cooked oysters and fried fish.

3. Meats: All smoked and seasoned meats; ham, tongue, corned beef, sausages, pork; all hashes and stews; turkey, lamb, gravies; eggs in some cases.

4. Vegetables: Beans and peas.

5. Farinaceous foods: Heavy, soggy bread; batter cakes.

6. Dessert: Pies, cakes, ice cream.

7. Beer, ale, porter, coffee, ice water. Hard waters not to be taken if purer waters can be obtained; the solvent power of hard water is not as great as that of soft.

In general it may be stated that starchy, saccharine and oleaginous articles of food are to be preferred to nitrogenous ones, and if the patient can do without meat it is advisable

for him to drop it, or, if he craves it greatly, to eat fat meat only.

It must be admitted that there are some patients who do not do well on any one-sided diet, but for whom ordinary mixed diet is the best thing. Schreiber actually recommends that patients under ordinary mixed diet eat in addition eggs, either raw or boiled, and meat. Some physicians report success from the use of raw eggs and milk.

Dark meats, as of wild fowl, are to be avoided, and all meat extracts.

Some patients cannot eat fish but can take shell-fish in moderation.

Eggs may be tolerated by some patients but not by others, according to the condition of the digestion.

**Diet in Severe Cases.**—The writer's experience is favorable to adoption of the rigid milk diet for a *limited period of time*, and with careful observance of details. Milk diet has fallen somewhat into disrepute on account of indiscriminate and too prolonged usage, but if rightly administered it is exceedingly valuable in causing decrease of dropsy and amount of albumin in the urine, together with increase in the quantity of urea. From two to four quarts of skimmed milk and that only should be taken during the twenty-four hours as follows:

The patient is to take three or four times daily, and at regularly observed intervals, from two to six ounces of skimmed milk.

This must be taken slowly, and in small quantities, so that the saliva may be well mixed with it. The reaction of the milk to test-paper must be neutral or alkaline.

The first week is the most difficult to get over, unless the patient has a strong will.

During the second week two ordinary quarts (sixty-four fluidounces) may be consumed during the day. The milk must be drunk four times daily, 8 A. M., at noon, at 4 and 8 P. M. The hours may be changed, but regular intervals must be maintained.

If the patient comply with these directions he will complain neither of hunger nor thirst, although the first doses appear so very small.

The daily quantity may be increased to eighty or more ounces.

If, after having attained this quantity or more, the patient gets worse, diminish the amount to the quantity used the first week, and increase more slowly.

Constipation at the beginning is a good sign. This may be remedied by warm water injections, or by the use of castor oil, rhubarb, addition of sugar of milk to the milk, or by taking some bicarbonate of soda at bed time. If the constipation be obstinate a little coffee may be added to the morning dose of milk, or, towards 4 P. M., stewed prunes or a roasted apple.

If, on the other hand, diarrhoea results, and rumbling of the bowels is frequent, the milk is too rich or is being taken in too large doses.

Feverishness is no contra-indication to its use. If the patient be thirsty, he may drink Hydrox, Bethesda, Poland or Vichy water. If he have a strong desire for solid food at the end of the second or third week, he may have a little stale white bread or toasted bread with salt in the morning, and again at 4 P. M. Once a day at this time he may have some soup made of milk and oatmeal.

After continuing this treatment for five or six weeks it may be modified by allowing the milk only thrice daily, and once a day steak or a chop. Raw meat digests most easily, and should be used in preference to the cooked when possible.

It may be necessary to add a little salt to the milk in some cases, and in others to have the milk drunk when very hot. If the patient becomes flatulent, buttermilk is often beneficial in small quantities.

**Notes on Milk Diet.—I.** Exclusive milk diet must be abandoned when it causes too great polyuria, when symptoms of anaemia and exhaustion are noticed, and when the albumin

is but small in amount. In such cases allow vegetables and farinaceous foods, as oatmeal, cracked wheat, granula, wheat-ena, and, if the patient still loses strength, a small amount of broiled or roasted meat once daily at early dinner.

2. Milk which has been violently shaken is said to be better tolerated than that which is not.

3. When the stomach is very irritable an ounce of *iced* milk may be given every half hour.

4. When milk is not tolerated, peptonizing it sometimes results in toleration.

5. In some cases malted milk is better borne than milk alone.

6. Kumyss, matzoon or buttermilk may be substituted partly or wholly for the sweet milk, if the latter is not well taken.

7. The writer seldom finds patients who are unable to take milk when it is mixed with French Vichy water, beginning with one-third milk to two-thirds Vichy, and progressing to two-thirds milk and one-third Vichy.

8. In one desperate case (a boy of 8) which the author saw, the milk was made palatable by flavoring with vanilla extract and adding sugar. The patient took this with eagerness, though refusing other kinds of milk mixtures, and finally recovered.

9. When the patient has improved, arrowroot and rice, together with cereal foods, fat bacon, zwieback, butter, mutton-broth, chicken-broth, clam-broth and oyster-broth may be allowed.

10. In some cases clam-broth alone has been taken as a diet to the exclusion of milk, when the latter was not tolerated or failed to nourish.

There are some patients who seem to be entirely unable to bear the absolute milk diet and who do better on a carefully regulated mixed diet, avoiding the articles already mentioned. Whole wheat water is sometimes well tolerated by those unable to take milk.

Robin believes that a diet may be found for a given patient which will cause the minimum elimination of albumin. He begins treatment by an absolute milk diet as follows: From 7 o'clock in the morning to 10 at night he should take a pint of hot milk every three hours, in small mouthfuls, taking about half an hour to drink this quantity; three quarts will be ingested during the day. When tolerance has been established the quantity should be gradually increased until four or five quarts are taken during the day. Under the influence of this diet there will be at first in nearly all instances an increase in the quantity of albumin for the twenty-four hours. After this usually transient increase, the albumin falls until it reaches an amount which is almost stationary. At this point green vegetables, cooked fruits and bread are added to the dietary. Finally, eggs and meat are given if the milk-vegetable diet does not appear to influence the quantity of albumin. If the amount of albumin has been tested regularly, one will now be enabled to find the general diet that will cause the least elimination of albumin. In conclusion, Robin states: (1) During an absolute milk diet, the milk-vegetable diet or the milk-animal diet there is generally less albumin than when the dietary does not include milk; (2) albumin is increased when wine is substituted for milk; (3) eggs produce less albumin than a meat diet; (4) a diet of eggs and milk causes less albumin than absolute milk diet; (5) among the meats, veal and beef agree better with albuminuric patients than chicken and mutton; (6) fish always appears to increase the elimination of albumin; (7) the vegetables which cause the least elimination of albumin are potatoes, cauliflower and rice; (8) it is rare that the addition of bread to any diet will increase the elimination of albumin.

The writer is thus far unable to verify Robin's conclusions as to beef and fish.

Many patients are able to take matzoon or kumyss and grapes as a rule are well borne.

Anders advises when there is much dropsy a diet of dry bread, crackers, zwieback, skim milk, butter milk and mat-zoon.

Hirschfield allows six ounces of meat, thirteen ounces of bread, vegetables and fruit liberally, one and a half ounces of sugar and five ounces of fat daily.

**Mineral Waters.**—In general alkaline waters are to be preferred. These are very numerous in the United States. Among them may be mentioned the Buffalo, Londonderry and Waukesha waters.

The writer knows from experience the diuretic value of Waukesha water, having tested it in a case where the patient collected and measured the twenty-four hours' urine for 196 consecutive days. On hydrant water this patient voided less urine than water taken; at Waukesha more urine than water taken, the quantity increasing from twenty-five to thirty ounces per twenty-four hours to 100 ounces in a short time.

In cases associated with excessive deposits of uric acid the White Rock Lithia water may be used or French Vichy. Where gastric symptoms or constipation are a feature French Vichy water is certainly useful.

On the Pacific coast McNutt recommends the Napa Soda, Coronado, and Bartlett waters.

Not infrequently thorough washing out of the kidneys accomplished by ingestion of large quantities of water does great good. In one or two cases, which the author has seen, ten to twenty glasses daily of the still Londonderry Lithia water produced decided amelioration, albumin, casts and crystals diminishing in marked degree, and not increasing again after the quantity was lessened. Geneva water has also done the same thing in other cases.

In general, patient if dropsical should not drink more water than he voids urine for fear of increasing the amount of dropsy.

**Climatology.** — When the patient has recovered suffi-

ciently to be able to travel, he may with benefit be removed to a mild, dry, equable climate where he can be outdoors most of the time without danger. Care must be taken, however, not to seek too high an altitude nor a locality which is all climate without comfort. On this account Southern California is, on the whole, to be recommended in the locality between San Bernardino and Los Angeles. A well-appointed sanitarium is of course preferable to the ordinary hotel.

The writer greatly prefers Southern California (continuous residence) for the severe cases. Several of his patients are not only improving there, but able to work at their business or profession, though totally incapacitated at home in the Mississippi Valley. Patients who come home, under the impression that they have recovered, have found it necessary to return, and the severe symptoms subside again in the more equitable climate.

Every specialist knows the tendency of exacerbations to set in coincident with the violent changes of the weather near the Lakes and north Atlantic.

Doctor Waddell speaks highly of Avalon on Catalina Island, off the California coast, as a resort for those with chronic nephritis, especially in summer, the peculiar situation of the town being well adapted for such patients. On the mainland the district including Claremont is suitable.

Those who desire to break the long journey to California will find a pleasant and well-equipped sanatorium at Lincoln, Nebraska, under the charge of Dr. B. F. Bailey.

It goes without saying that in all localities visited attention should be paid to a marked difference in temperature, if any, between the night and the day, and wherever possible sleeping rooms should be provided with facilities for warmth if needed at night, the patient with a woolen night-dress and the bed with blankets.

Those who are able to travel abroad or take sea voyages may visit the following:

In the West Indies, the Barbadoes. In Europe, Pau, Cannes, Rome, Naples, Malta, Malaga. In Africa, Algeria and upper Egypt; the dry plateau north of Cape Town.

During the winter in America patients may go to Eureka Springs, in Arkansas; to Tallahassee, Aiken, Thomasville and San Antonio.

Patients whose hepatic functions are greatly deranged may when in Europe visit Vichy, Carlsbad and Marienbad for a time, and during the proper season at these resorts. Residence on the border of the African desert (Sahara), as at Helouan, near Cairo, is said to have a favorable influence on the albuminuria of renal disease.

**Remedies.**—Modern writers are somewhat skeptical as to value of drugs in the treatment of chronic nephritis, and have more confidence in diet and regimen. It is indeed difficult to ascertain the value of remedies in this disorder owing to the tendency toward remission of the symptoms from time to time. This tendency toward remission may be the cause of misplaced confidence in a remedy when used just before the remission takes place. Certainly in no other disorder is there a greater field for the empiric. The writer seldom sees a patient with chronic nephritis who has not tried some secret nostrum, and who reports that it did him "a great deal of good for awhile, and then seemed to lose its effect." The sale of these preparations throughout the United States is very large, and the confidence of the public in them seems to be as great as the sale. Moreover, when in addition to the nostrum directions for diet and hygiene are given the latter undoubtedly help the former very materially.

In spite of the value, which is undoubtedly, of diet and hygiene the writer still clings to the hope of discovering the constitutional remedy for the individual in question. There is no doubt so far as clinical experience goes to show that the individual has his drug as he also has his diet, his regimen, and

his climate. How or why the drug acts when it does act is a matter with which we are not directly concerned in these pages.

In chronic diffuse nephritis without induration we find about the same drugs used by various practitioners of internal medicine as in acute nephritis.

**Symptomatic Treatment.**—*Ferrum, Arsenicum, Cantharides, Mercurius cor., Apis, Nitric acid, Nux vomica, Phosphorus* are the remedies, as well as others mentioned under acute nephritis whenever acute exacerbations appear. Of these the writer relies chiefly on iron and arsenic.

**Ferrum.**—The indications have already been given under acute nephritis. This drug is used more than any one other by the writer.

Of the different preparations of iron Basham's mixture and Boudreaux's syrup or pills have proved by far the most serviceable. Basham's mixture (acetate of ammonium and iron) prepared by a good pharmacist so as to make a clear solution is given in doses of from one to two fluidrachms four times daily in plenty of water, continuously for months if necessary. Boudreaux's syrup or pills of the protochloride of iron seems especially efficacious in the case of anaemic women. The dose of the syrup is the same as that of Basham's mixture. A preparation known as haemoglobin with or without arsenic has appeared to be of therapeutic value in one or two cases. In cases in which the above are for any reason not well tolerated Hensel's iron sometimes does admirably, or the preparation known as hemapeptone. It should not be given when there is high tension or when digestive disturbances are marked. The writer has seen oedema and albuminuria decrease and strength improve in a number of cases, apparently due to the action of iron. *Ferrum muriaticum* is used by many practitioners for chronic nephritis.

**Arsenicum.**—When there are the usual symptoms, weak-

ness, restlessness, anguish, thirst for small quantities, dark, cloudy urine, nausea, anasarca and headache. All these symptoms are aggravated by warmth. This remedy acts well in chronic nephritis due to scarlet fever or malaria, and especially in large white kidney, and when there is hydrothorax. The writer uses the second decimal trituration of *Arsenicum album* or the iodide in cases where waxy casts are found, also Hemoglobin with Arsenic in the case of anæmic women. Goodno suggests drop doses of Fowler's solution, three times daily, gradually increased if necessary to five drops. In cases complicated by pregnancy and miscarriage the *Bromide of Arsenic* in the third trituration is suggested by Dr. Searle, of Brooklyn. Next to *Ferrum* the writer uses *Arsenicum* most, and sometimes alternates it with the former.

*Cantharides* may be given when the urine is scanty, dark, highly albuminous, micturition frequent and perhaps painful, stomach irritable and dropsy general. Use the lower potencies or even a good tincture in drop doses, three times daily, gradually increased to ten times, as suggested by Goodno. It is useful in relieving headache, delirium and coma in the early stages of chronic nephritis. There is mental stupor, drawing, tearing pains in the region of the kidney, thirst and aggravation of urinary symptoms by drinking water.

*Apis* is suggested when œdema of the lids is a feature, with scanty or suppressed urine in acute intercurrent attacks. This remedy is also to be thought of when there is much albumin still in the urine with but few casts, and few or no other symptoms of the disease. Use the third decimal trituration of *Apium virus*.

The writer has seen, however, thus far little benefit derived from use of *Apis* in chronic nephritis, unless in alternation with *Apocynum* or *Sambucus* in cases of dropsy.

*Mercurius corrosivus* is to be used when there is general œdema, when the patient is anæmic, weak, restless, urine highly albuminous and still rather scanty, stomach and

bladder irritable, pulse quick and feeble; especially in syphilitic cases. Goodno advises doses of one or two drops of the third decimal dilution every three hours. Mercury was regarded by Dr. H. B. Millard as indispensable in the treatment of this class of cases. He advised *Mercurius corrosivus* and also the Protiodide and Biniiodide.

*Nux vomica* and *Nitric acid* when gastric symptoms are conspicuous. *Nux vomica* for irritable, morose patients, Nitric acid in cases where there is great weakness especially in the morning.

*Phosphoric acid* when there is excessive loss of flesh and strength or after dropsy has been removed, and the patient is weak.

*Phosphorus*.—Weak empty feeling in the whole abdomen; poor memory; fatty casts abundant in the urine; painless, watery diarrhoea, dimness of sight, hoarseness, pneumonia, jaundice, fatty degeneration of kidneys and liver, tuberculosis, caries. Use the third decimal.

*Potassium chlorate*.—Progressing cases where anaemia, breathlessness, palpitation, scanty urine, and marked albuminuria are features.

*Protonuclein* may be given as a constitutional remedy in doses of four three grain tablets four times daily until headache appears from its use, when the dose is reduced to three times or twice daily and continued for a long period.

Dr. E. E. Vaughan reports to the writer a case in which he gave this remedy in a supposedly hopeless case with apparently good effect, recovery taking place in a few weeks; antiphlogistine was applied to the region of the kidneys fresh every twenty-four hours and in addition to the *Protonuclein*, *Arsenicum 3x* and *Baptisia* were given.

*Strophanthus* according to Royal is serviceable in dropsical cases of chronic diffuse (non-indurative) nephritis. When given in either the *2x* or *3x* the first effect is an increased flow of urine, decrease of the dropsy, also of albumin, casts

and crystals. And what is of greater significance, the improvement thus secured lasts for a remarkably long time before the disease resumes its fatal course.

*Terebinth* is the remedy in cases of acute intercurrent attack following exposure to cold, or in haemorrhagic cases where albumin and blood appear in increased quantity in the urine as soon as the patient gets up and moves about. Use the lower potencies or drop doses of the oil increased gradually to not more than five minims.

*Apocynum, Aurum muriaticum, Digitalis, Jaborandi* and *Glonoin* are likely to be needed sooner or later in the course of the disease. *Helonias, Hellebore, Antimony, Belladonna, Cuprum, Acetic acid, Stramonium, Erigeron, Millefolium, Coccus cacti, Pichi* and the *Iodide of potassium* have been commended by various writers for special use in certain cases. It may happen, that before good results can be obtained from the use of remedies, the bowels must be regulated by use of Carlsbad Sprudel salt, *Podophyllin, Leptandrin, Sulphur* or *Nux*.

As a palliative the writer has used *Lactate of Strontium* in connection with milk diet when albuminuria is stubborn.

Use five drop doses of the Paraf-Javal solution, increasing rapidly if tolerated by the stomach to doses of a fluidrachm four times daily.

This drug was recommended at one time as of service in reducing the amount of albumin in the urine, but modern writers doubt its efficacy. In several cases where the writer has used it albumin has certainly diminished in amount for the time being, but whether due to diet and régime or to the drug alone can not be said.

#### SPECIAL THERAPEUTIC MEASURES.

Cases of moderate severity, if taken in time, will sometimes yield under treatment already described, and either a relative

cure takes place, or occasionally an absolute recovery. Obstinate cases resisting general treatment develop special features, which imperatively demand special therapeutic measures, though the relief obtained be but temporary. Even in these severer cases recovery sometimes takes place when least expected.

**Troublesome Features.**—The special features likely to cause trouble are, in usual order of frequency, the following :

1. Dropsy.
2. Dyspnoea.
3. Circulatory and cardiac troubles.
4. Gastro-intestinal disorders.
5. Uræmia (convulsions).
6. Renal haematuria.
7. Persistent albuminuria.

**Treatment of Dropsy.**—The methods by which dangerous dropsy may be reduced are the following, in order of efficacy :

1. By sweating and purging (diaphoresis and catharsis).
2. By stimulating the kidneys (diuresis).
3. By increasing the activity of the circulation.

**Diaphoresis.**—Hot baths, vapor or dry, hot packs, alcohol sweats, jaborandi.

Sweating may be brought about by the warm bath, as already described, by the vapor bath, hot-air bath, alcohol sweat, or hot wet pack.

Alcohol sweats are given by saturating flannels with 50 per cent. alcohol, wrapping them round a jug of hot water, and also round hot bricks. The water jug is placed under the patient's flexed limbs, and the bricks at his side, not near enough to burn. All, including the patient, are wrapped in flannels.

Vapor baths or hot-air baths are not always well borne by feeble or elderly patients. Warm baths, as already described, are safer.

In giving the warm bath the temperature should be about

100° F. when the patient is put into it; then gradually increased to 104° or 106° F. and the patient allowed to remain in it for half an hour or more, following which he should be well-wrapped for two or three hours.

The use of Jaborandi in connection with other methods of sweating has been described under ACUTE NEPHRITIS. It must be used with great caution in chronic nephritis and always supplemented by digitalis or hypodermics of brandy or ether if necessary.

The hot wet pack may be given to patients with whom the warm bath disagrees or for whom it is impracticable. A large double blanket is immersed for a few minutes in water of a temperature just below boiling, wrung out quickly and wrapped about the patient, leaving the head exposed. The patient is then put to bed and well covered with dry blankets for two hours, during which time he should be given hot drinks freely, or barley water or rice water. He is then removed from the pack, thoroughly rubbed and placed in warmed dry blankets.

The hot air bath is useful on account of the ease with which it can be administered. It is frequently all that is necessary in starting the perspiration in cases where the heart's action allows use of it, but in feeble or elderly patients it may be dangerous. The writer has seen it produce cardiac failure in one or two cases of weak, enfeebled old men, so that strychnine may be necessary for administration when such an untoward event takes place. The hot air bath may be given by placing an alcohol lamp on the floor, near the bed, and carrying a funnel bent at right angles from the lamp up under the bed clothing which must envelop the patient closely; a light cradle may be extemporized to support the bed clothing if desired. Should the skin remain hot and dry a warm, stimulating drink will usually start the perspiration, or a hypodermic of pilocarpine may be given in dose 1-10th of a grain, repeated in twenty minutes.

The writer has been called on occasionally to give a hot

bath to a patient in remote localities where facilities for a bath of almost any kind were lacking. The best substitute which was thought of was to have the patient sit on a cane-seat chair or one with a perforated seat, and to place the alcohol lamp under the seat of the chair while the patient and chair were inclosed in a blanket wrapped around the patient's neck, leaving the head exposed. In spite of the danger of setting fire to nearly everything, I have several times succeeded in bringing about satisfactory diaphoresis by this crude means.

A point of importance about the administration of the hot air bath is that it must be *repeated* in cases where the skin has been dry and inactive for some little time. In a case in which no history of free perspiration for a month past could be had, the first hot air bath produced almost no perspiration about the lower extremities, but the second one given on the following day brought about copious perspiration from head to foot.

Purging may be accomplished by giving tablespoonful doses of a saturated solution of Epsom salt every three or four hours, or by giving two tablespoonfuls of the salt itself, dissolved in half a glass of water, at 7 A. M. and 4 P. M., for five or six days, if necessary, or by giving a tablespoonful of Rochelle salt mornings before breakfast in cases more amenable to treatment.

Obstinately constipated cases may require 1-10th grain of *Elaterium* at night, or 1-20th grain to 1-8th grain every four hours till free watery stools are produced. Moreover, this drug is in some cases less weakening than massive doses of salts.

Patients with chronic nephritis do not always tolerate salts as well as do those with passive congestion of the kidneys. Epsom salt should not be forced upon a patient who does not feel the better for it.

If *Elaterium* produces nausea or vomiting, the alkaloid *Elaterin* may be given in doses of 1-16th of a grain every four

hours until frequent watery discharges are produced. Compound Jalap powder may be tried in doses of from thirty to sixty grains. If the hepatic functions are sluggish, *Mercurius dulcis* may be given in the form of tablets of the first decimal trituration, one tablet every hour at night, between dinner and bed time, followed by a Seidlitz power on rising in the morning.

Saline or glycerine enemas may be useful in promoting the movement of the bowels.

**Diuresis.**—On the whole *Digitalis* in the form of fresh infusion is the most reliable diuretic and the writer formerly a believer in the efficacy of apocynum has of late relegated the latter to second place. It goes without saying, however, that there are those on whom apocynum acts admirably and sufficiently. The dose of digitalis infusion is from two to four fluidrachms three times daily.

A preparation known as *Hydragogin* is well worth considering as a diuretic. The writer reduced extreme dropsy in a case of a year and a half standing with it in one week. Hydragogin contains tincture of digitalis and tincture of strophantus, together with solutions of scillipicrin, scillitoxin, and oxysaponin—in other words, digitalis, strophanthus, the active principles of squill and the glucoside oxysaponin. The remarkable diuretic action of the preparation is thought to be due to the support given by oxysaponin to the other remedies. Oxysaponin is a glucoside obtained from *Herniaria Glabra* and when administered alone excites diuresis and watery stools.

Hydragogin is given in doses of fifteen drops in one-fourth to one-half pint of water every hour for thirty-six hours with the nausea, on a strict milk diet, unless it cause after the third dose patient malaise, weakness, loss of appetite and dislike of the remedy. In such a case discontinue for half a day, then give it in five or ten drop doses every two or three hours. When the full physiological effects of the remedy are evident, as

shown by copious watery stools and marked diuresis, it is discontinued altogether for a brief period of time and then resumed in smaller doses at longer intervals as five to ten drops three times daily.

Goldberg has used hydragogin for eight years in more than one hundred cases. His description of one noteworthy case is as follows:

The patient, a man of 64 years, with gray hair and a flowing white beard, was sitting in a comfortable armchair, his face intensely red. He was laboriously gasping for air. The table at his side was literally loaded down with full and partly empty bottles of cognac, port wine, Burgundy, Champagne and similar liquors. Two nurses from the Elisabeth training school at Berlin stood at either side in their trim uniforms, and alternately administered some of the contents of the bottles in the endeavor to prevent the threatened collapse. Physical examination showed very considerable ascites, marked œdema extending from the feet up to the hips; the apical impulse was evident in the mammary line and the sixth intercostal space, the heart sounds were not attended by any murmurs, the pulse beat ninety-two times per minute, frequently intermitting; arterial movement was rigid; diffusely scattered over the lungs moist rales were heard, the breathing was asthmatic. The patient passed  $\frac{1}{4}$ - $\frac{1}{2}$  litre of urine in the twenty-four hours, and once daily or every second day his bowels moved in response to drastic purgatives. For the past three weeks, also, the patient had not been to bed, his inability to assume the recumbent position compelling him to remain in his easy chair day and night.

On Monday morning, February 13, the patient first took hydragogin. By Wednesday evening, the 15th, he had already passed 14300 c.c.m. of urine, not including the amount of water in the very frequent and liquid evacuations from the bowels; the patient felt much better, and could lie in bed without any appreciable discomfort. By the following Satur-

day evening, February 18, the patient had passed somewhat more than twenty-four litres of urine, all swelling had disappeared, and he felt so well that on the following Monday he went to his office on the floor below, and was able to attend to his business as usual.

In this case of Goldberg's the condition of arterio-sclerosis was probably present.

The writer's case, however, was one of chronic diffuse nephritis without induration, and with extreme œdema and ascites in a young woman without arterio-sclerosis. She had been gradually growing worse for eighteen months, until finally she was confined to the house. In a week from the time when she began taking hydragogin she was at her work again; a slight degree of œdema persisted about the ankles.

E. Tutschulte has used hydragogin in ten cases. His custom has been to begin with a small dose, five drops, every two hours, and gradually increase until the patient gets fifteen every two hours. [In one case, not renal, there was acute cardiac dilatation with murmurs at both apex and base, the result of chronic endocarditis, great ascites, œdema of limbs and face, but urine normal though scanty. There was intense headache, dizziness and dyspnoea. Ascites and œdema disappeared in five days under treatment by hydragogin.]

H. A. Watson in the Chicago *Clinic* for August, 1902, describes the action of hydragogin on a boy 12 years of age, suffering from chronic nephritis two years after an acute attack following scarlet fever. The usual measures for relief of dropsy, dyspnoea, etc., were tried without avail. Hydragogin in twenty drop doses, three times daily, gradually caused the disappearance of ascites and œdema, and diminution in the amount of albumin. He also cites several other cases where its administration was beneficial.

In order to overcome secondary heart failure it may be necessary in some cases to give heart tonics or stimulants as well as the diuretic, for example :

Sparteine in one-grain doses of the first decimal trituration every three hours, or five grains of the second decimal every two hours; or fluid extract of Corn Silk ten to twenty drops every two hours; or Citrate of Caffeine in four- to eight-grain doses every four hours (alone or combined with Paraldehyde at night); or ten-drop doses of Adonis vernalis four times daily; or Strophanthus in doses of two to five minims of the tincture. Strychnine, night and morning,  $\frac{1}{100}$ th of a grain in addition to catharsis and diuresis.

Inasmuch as hydragogin contains both Strophanthus and Oxsaponin the above are not necessary when it is used.

*Apocynum* is unquestionably a potent diuretic in many cases, but frequently it is necessary to give it in doses sufficient to produce vomiting and purging before its diuretic action takes place. The tincture is said to be better than the infusion for the reason that the cardio-kinetic principle of the drug is soluble in alcohol but not in water. The dose of the tincture is from fifteen drops to half a fluid drachm, or even more. The writer has seen patients who were nauseated by seven drops of the tincture, and again those who could take a teaspoonful without nausea and without diuresis. In one case diuresis was brought about by forty-drop doses of the tincture every three hours.

In the less urgent cases of dropsy with the usual indications for the drug it may be administered with benefit, beginning with small doses, five drops every three or four hours, and increased if necessary. The writer, however, is at a loss to account for its prompt action in certain cases and its failure in others unless it be that it is better suited to congestion of the kidneys than to inflammation.

In order to obviate the unpleasant effects of *Apocynum*, Dr. C. A. Williams, of Chicago, combines it with Corn Silk and Wild Cherry as follows: Fresh alcoholic tincture of *Apocynum*, one fluid ounce; fluid extract of Corn Silk, two fluid ounces; syrup of Wild Cherry, three fluid ounces; dose, one teaspoonful every two to six hours as required.

The general indications for the use of Apocynum are said to be as follows: There is present a weak, gone feeling at the pit of the stomach, so that the food is not well borne; there is much thirst, and drinking is attended with great distress. The heart's action is irregular, and the pulse is slow.

The writer has, however, found it serviceable where none of these indications except the cardiac ones were present.

Macy's diuretic mixture (used by Laidlaw and others) is as follows: The tinctures of Apis, Apocynum, Helleborus mixed in equal proportions. Ten drops of this mixture are mixed with four ounces of water, and one teaspoonful given every hour or two.

*Theobromine* either alone or in the form of diuretin or agurin is used as a diuretic. In the writer's experience this drug is not to be depended on unless a considerable portion of the kidneys is intact, hence is of more value in cardiac drop-sies or in alternation with other diuretics.

A favorite diuretic is *Cream of tartar* in doses of from thirty to sixty grains or more, three times daily, in a pint of lemonade.

In desperate cases after failure of other remedies a pill of Calomel, Squill and Digitalis, one grain each, is sometimes effective, as suggested by Dr. R. H. Fitz, of Boston.

The Acetate and the Citrate of Potassium are useful diuretics. A very common combination is that of Acetate of Potassium and Digitalis. Sometimes both the acetate and citrate are given together in solution.

**Bandaging.**—The tense abdomen is to be annointed with oil, covered with linen soaked in oil, and over this a flannel bandage is applied. The lower limbs, which are œdematos and usually cold, are treated in like manner, being wrapped in oil-soaked linen, over which a flannel bandage is drawn with moderate pressure, care being taken that it is not too loose. By this means it is usually accomplished that the limbs feel comfortably warm by the following day.

**Normal Salt Solution.**—This may be used after colon flushing as a means of promoting diuresis.

**Puncture.**—If the dropsy resists all treatment, after delaying as long as possible puncture the legs above the ankles or make several moon-shaped incisions just below the internal malleolus. The incisions may, however, refuse to heal and the dripping, as in a case of bursting, proves a serious burden to the patient. Puncture of the scrotum often gives much relief and in cases which the author has seen has not produced ill results.

**Paracentesis.**—In some cases where the patient is unable to tolerate drugs or the latter are inefficient it may be necessary to perform the operation of paracentesis abdominis.

**Treatment of Dyspnœa.**—Eliminative measures are most useful. The writer cannot recollect a case of dyspnœa which was not at least ameliorated by the production of copious watery stools as by use of Epsom salt or Elaterium.

Jaborandi may be needed in order to promote diaphoresis, but it must be very carefully used. Diuretics as already described will aid in the case.

Strychnine may be needed when the heart is weak and Glonoin when there is high tension.

*Aspidospermine* has been used successfully in the treatment of dyspnœa ; it may be given in doses of two to four metric granules ( $\frac{1}{67}$ th grain each), together with five to sixty drops of the fluid extract of *Passiflora*, every ten or fifteen minutes until relief is to be had. For the weakness after an attack the *Arsenate of Strychnine* in doses of one metric granule ( $\frac{1}{134}$ th grain) may be given every fifteen minutes until the patient is stronger, then four times daily for a few days.

**Treatment of Headache.**—Headache in this disorder may be the result of high tension from toxæmia or of hepatic origin. In the former case Glonoin, the Nitrates and the Chloride of Gold and Sodium may palliate, together with eliminative measures.

In a case which the writer treated of violent sick headache with vomiting the attacks were much decreased in severity and diminished in frequency by administration of Fairchild's pepules of Ox-gall, Pancreatin and Nux vomica. The patient was a young woman of sallow complexion with movable right kidney and chronic diffuse nephritis without induration in both kidneys, as ascertained by use of the Harris segregator. The patient had been tormented with these headaches, occurring at irregular intervals every week or so for months and the benefit derived from the pepules seemed unquestionable.

Mercurius dulcis, Euonymin, Carlsbad Sprudel salt and Sodium Phosphate may be tried in cases of apparently hepatic origin.

Strict abstinence from meat is to be enjoined in these cases, but alone will not prevent the attacks.

**Gastro-intestinal Disorders.**—Obstinate vomiting is sometimes a distressing feature. A certain amount of vomiting is regarded as an effort of nature to rid the circulation of toxins and should not be interfered with. But when there is persistent retching and the patient is growing weak, effort must be made to relieve the condition. *Chloretone* in five grain doses followed by a drink of cold water is sometimes efficacious, especially in alcoholic cases. (See CHRONIC INTERSTITIAL NEPHRITIS.)

It is said that Apomorphine,  $\frac{1}{10}$ th grain hypodermically, will sometimes relieve it. A dose of four drops fl. ex. Ergot and five of Chloroform in a teaspoonful of water relieved one of my cases for the time being, but reliance must in general be put upon eliminative treatment, sweating, or Jaborandi.

**Increased Arterial Tension.**—Whenever the pulse becomes tense and it does not yield to symptomatic treatment very speedily, vomiting, headache, dyspnoea and convulsions may appear, so that to forestall the development of these symptoms we must use Nitroglycerine  $\frac{1}{100}$ th grain, Aconite first decimal

or Morphine if imperative, hypodermically, one-eighth of a grain; Chloral hydrate or Iodide of potassium may be serviceable occasionally.

**Cardiac Weakness.**—This may require Digitalis, Strophantus, Spartein, Caffeine, Adonidin, Convallaria, Cactus. Hypodermics of  $\frac{1}{100}$ th grain of Glonoin may be used; Digitalis in five to ten drops of the tincture, or Convallaria in like dose; Cactus in like dose, or even twenty to thirty drops, plus  $\frac{1}{100}$ th grain of Strychnine as suggested by the late E. M. Hale.

Spartein is given in doses of one grain of the first decimal trituration every three hours; Caffeine in doses of from two to five grains every three hours.

**Uræmia.**—Uræmic symptoms as nausea and vomiting, drowsiness, stupor, coma or convulsions are to be treated as described under ACUTE NEPHRITIS. There is usually more danger in the use of Jaborandi in chronic nephritis than in acute, hence necessity for caution. It should not be given where there is pulmonary œdema.

To prevent uræmic convulsions Searle gives one-half pint of lemon juice each twenty-four hours, in divided doses mixed with water.

In chronic poisoning of long standing, milk diet, laxatives and hot air bath is about all that the patient can stand when his kidneys have become incapable of performing their functions.

In the last stages of uræmia when there is eclampsia intramuscular injections of saline solutions may be used.

For uræmic twitchings Glonoin may be used. Lactate of strontium in fifteen- to twenty-grain doses seems to be serviceable in uræmic cases.

**Hemorrhage.**—In the writer's experience (confirmed by Dr. McMichael, of New York) in many cases tincture of Thlaspi bursa pastoris in thirty-drop doses, four times daily or oftener, will stop excessive flow of renal blood when other agents fail. Its use may need to be kept up for several weeks. Other reme-

dies are Turpentine, Erigeron, Millefolium, Coccus cacti and Pichi, to say nothing of the crude astringents Trillium, Geranium (fifteen to thirty drops), Hamamelis (thirty to ninety drops), Gallic acid (two to ten grains), Ergot (three grains of the extract), fluid extract of Red Gum.

Ergotinine may be used in persistent haematuria. It often fails, however, to stop the hemorrhage.

**Electricity.**—The use of static electricity for the treatment of chronic nephritis is now much in vogue.

Neiswanger, of Chicago, reports a number of cases cured by this means.

**Surgical Measures.**—R. Harrison has called attention to the improvement in certain renal cases after exploratory operation, in which no recognizable cause had been discovered for the clinical symptoms, and said it seemed reasonable to infer that these results were due to the relief of renal tension. Different from the times of Bright, we can now see and explore a living kidney with ease and safety *in situ*.

The following may be regarded as some indications for relieving tension surgically: Progressive signs of kidney deterioration; suppression of urine or approaching that state; marked disturbance of the heart and circulatory apparatus arising in the course of inflammatory renal diseases.

Harrison splits the capsule along the convex border; or, if indications for exploration of the kidney are present, he extends the cut through the kidney substance into the pelvis. Numerous punctures over the surfaces of the organ may be made. A drainage tube is then inserted and the wound is sewed up about it. Drainage is essential, from seven to ten days usually, as there is always considerable discharge. It is a matter of indifference as to which kidney is operated upon unless there is something to indicate it, such as pain, since the relief of tension in one kidney relieves the other.

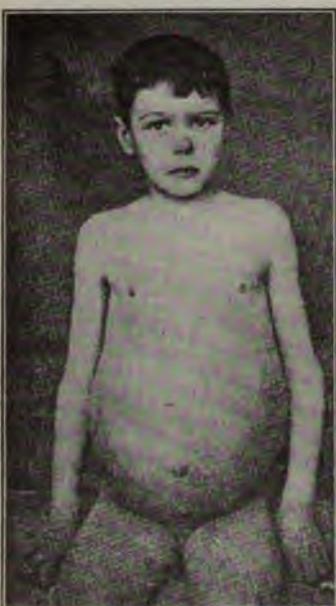
Edebohls, of New York, performs the operation of *Capsular nephrotomy* for the cure of Bright's disease. Primrose, of Toronto, has also performed the operation.

Primrose's case was as follows: A child 10 years of age suffered from nephritis. The history is obscure as to the onset of his illness, but for six months before he had general anasarca and ascites. During that time paracentesis abdominis had been performed seven times. On admission to the hospital on November 8, 1901, the urine contained 1.6 per cent. of albumin, the abdomen was enormously distended with fluid and there was great swelling of the face and œdema of the extremities. The lad's general condition was considered very serious and a gloomy prognosis was given. Paracentesis abdominis was performed and 180 ounces of fluid drawn off from the peritoneal cavity. The urine, which contained the large amount of albumen indicated, also contained numerous hyaline, granular and epithelial casts.

On November 21st he cut down upon the right kidney in the loin; he found it much enlarged, and made an incision two inches long through the capsule and subsequently drained the lumbar wound for a fortnight. As a result of the operation the amount of urine secreted in twenty-four hours gradually increased from fourteen ounces in twenty-four hours to forty ounces on the seventh day after the operation, while the percentage amount of albumin diminished from 1.6 per cent. to 0.8 per cent. The child's condition, however, did not continue to improve and it appeared evident that permanent relief of symptoms had not been secured. One was encouraged, however, by the profound effect produced upon the condition of the patient by the simple operation upon the right kidney of splitting the capsule, and it was therefore thought justifiable to perform a more extensive operation upon the left kidney. Accordingly, on December 20th, forty-two days after admission to the hospital, he cut down upon the left kidney and removed the kidney capsule in its entirety. The child, though critically ill after the operation, eventually recovered.

The disappearance of albumin and casts from the urine after operation on the kidney has been noted by many observ-

ers, such as Rose, Newman and Ferguson. We are mainly indebted, however, to Harrison, in England, and to Edebohls, in America, for pointing out the bearing which these results have on the question of the possibility of curing albuminuria by surgical means. (*Pediatrics.*)



Photograph of patient on November 19, 1901, two days before the first operation on the kidney.



Photograph of patient on February 3, 1902, forty-five days after the last operation on the kidney.

FIG. 15.

Edebohls performs the operation as follows:

"Excision of the renal capsule proper is performed as follows: The patient is placed prone upon the table, with the kidney air cushion underlying and supporting the abdomen. Both kidneys are thus rendered accessible to operation without the necessity of changing the patient's position. An incision is carried from the twelfth rib to the crest of the ilium

along the outer margin of the erector spinae, without opening the sheath of that muscle. The fibers of the latissimus dorsi muscle are bluntly separated in the direction of their course without cutting. The ilio-hypogastric nerve is sought for and drawn to one side or the other, out of the way of harm. Division of the transversalis fascia exposes the perirenal fat. This is divided over the convexity of the kidney until the capsule proper is reached. The fatty capsule is now bluntly separated everywhere from the capsule proper, the dissection advancing on either aspect and around both poles of the kidney until the pelvis of the kidney is reached. Now and then the fatty capsule may be found so thickened and adherent, as the result of chronic perinephritis, that the scissors or knife may be required to separate it from the capsule proper. The kidney with its capsule proper is next lifted from its fatty capsule bed, and, if possible, delivered through the wound. The capsule proper is divided on a director along the entire length of the convex external border of the kidney and clean around the extremity of either pole. Each half of the capsule proper is in turn stripped from the kidney and reflected toward the pelvis until the entire surface of the kidney lies raw and denuded before the operator.

In separating the capsule proper from the kidney, care must be exercised not to break or tear away parts of the kidney, which is often both very friable and very firmly connected with its capsule proper. The stripped-off capsule proper is next cut away entirely, close to its junction with the pelvis of the kidney, and removed. Delivery of the kidney makes this otherwise difficult work easy. If the kidney cannot be delivered, the capsule proper must be entirely peeled off the kidney by the fingers in the bottom of the wound, and excised as far as possible, any remaining portion being simply reflected backward around the root of the kidney, where it will curl up and stay. The kidney is dropped back into its fatty bed and the external incision is closed. Drainage, except when the

parts are extremely œdematous, is dispensed with. After both kidneys have been thus operated upon, the dressings are applied and the patient is put to bed.

Renal decapsulation is not directly and forthwith curative of chronic Bright's disease, but it leads to a cure or improvement of the disease by establishing circulatory conditions essential to such cure or improvement.

The final disappearance of albumin and casts may require from one to twelve months. It is also possible that cicatricial formation may lead to trouble later on.

A practical difficulty in the way of this operation is the unwillingness of many patients to submit to it owing to the fact that Bright's disease being a disorder in which remissions frequently occur the patient unless badly dropsical does not realize the gravity of his condition.

[It may be observed in connection with this operation that Mongour has decided to abandon fixation of the omentum in the hope of re-establishment of the portohepatic circulation in cases of ascites due to cirrhosis of the liver.]

In regard to the anaesthetic employed Edebohls says :

"Contrary to general opinion as to the safest anaesthetic for renal operations, ether was used in all but one of the eighteen cases, and it would seem from the results that the fear of ether, as an anaesthetic in the presence of renal disease, is not well grounded.

"Ether was the anaesthetic employed in all of my operations but one, on these eighteen sufferers from chronic Bright's disease. Upon many of them I performed operations additional to the kidney operation, always under ether, and in not one instance was the slightest untoward effect observed. Case No. 18 was operated upon under combined nitrous oxide and oxygen anaesthesia conducted by Dr. Thomas L. Bennett. I see no good reasons why any surgeon should not use, in his operations upon the kidney, the same anaesthetic to which he is accustomed in his operative work generally.

"Personally, I would prefer, especially in cases of far advanced Bright's disease, nitrous oxide and oxygen, provided I could always command the services of an expert like Dr. Bennett to administer the combined gases; otherwise I would choose ether. My third choice would be spinal cocaine anaesthesia, which I have found particularly well adapted for work upon the kidneys.

"There has thus far been no mortality in my operations upon the kidneys of patients affected with chronic Bright's disease. All of my patients recovered from the operation and, as far as my knowledge goes, all but two are alive to-day. One of the two died after an operation for ruptured tubal pregnancy, performed by another surgeon, exactly one year after my operation on her kidneys; the other succumbed to a hysterectomy, also performed by another surgeon, eight years after my operation on her right kidney." (*Era*.)

The writer's experience in regard to chronic Bright's disease is, however, that it is quite as frequently a question of the condition of the lungs and breathing apparatus generally as of the heart, and that in *elderly patients* it is exceptional to find one in whom both the respiratory and circulatory systems are in fit condition for anesthesia.

## CHAPTER IX.

### CHRONIC DIFFUSE NEPHRITIS WITH INDURATION. (CHRONIC INDURATIVE NEPHRITIS).

**Definition.**—A form of chronic diffuse nephritis in which the new cells in the stroma proceed to form mature connective tissue resulting in induration or hardening of the kidney. Round cell infiltration and connective-tissue proliferation in the stroma are marked in this variety of renal disease.

**Forms.**—There are three forms, namely, secondary chronic interstitial nephritis, primary chronic interstitial nephritis and arteriosclerotic kidney. The first is the most frequent type of all chronic renal diseases—according to Riesman.

#### SECONDARY CHRONIC INTERSTITIAL NEPHRITIS.

**Synonym.**—Atrophy of the kidney.

This form represents an advanced stage of chronic diffuse nephritis without induration, in which, as previously remarked, there are evidences of connective tissue proliferation. If a case of chronic diffuse nephritis without induration lasts long enough, the connective tissue proliferation becomes more marked and results in an increased consistence of the kidney and not infrequently in a reduction in size. Intermediate stages may be found, so that it is not always possible to draw a sharp line between the forms without induration and those with it. Inasmuch as some cases of diffuse nephritis without induration take a subacute rather than a chronic course, the line between even acute nephritis and chronic with induration is not always to be sharply drawn.

Secondary chronic interstitial nephritis is, however, more likely to follow the large mottled kidney than the large

white kidney, inasmuch as the patient lives longer with the former disease than with the latter.

**Pathologic Anatomy.**—*The Kidneys.*—Size depends upon duration of disease and amount of blood in the vessels, hence may be normal, larger or smaller than the normal. The *consistence* is greater than normal. The color dark-red, mottled or grayish yellow.

*The Renal Surface.*—Either smooth or slightly granular; presence of cysts not unusual.

*The Capsule.*—Strips easily except in spots.

*Section.*—Shows the cortex variable in width; in some places wider than normal, in others narrower. In appearance the cortex is opaque and mottled.

In contracted kidney there are always bits of normal tissue interspersed between the numerous separate foci of disease.

**Pathological Histology.**—The principal change is in the cortex whose glomeruli are especially affected. Such as escape degeneration are in many cases larger than normal. There is more or less degeneration and *atrophy* of the tubules, some of which are replaced by connective tissue and others dilated into cysts. The stroma is increased in width by round-cell infiltration and new formation of connective tissue. Changes in the stroma are secondary to parenchymatous degeneration.

**Etiology.**—The cause of this disease is chronic diffuse nephritis without induration, of which it represents an advanced stage.

**Clinical Features.**—Left ventricle hypertrophied, and, if disease lasts long, dilated.

Aortic second sound accentuated. Pulse tension increased. Dyspnoea frequent, may be asthmatic in character, due partly to uræmia, partly to pulmonary oedema, or hydrothorax. Uræmic symptoms more severe than before induration; dysentery, delirium, coma, convulsions, paralysis, retinitis not so common as in the interstitial form. There is less oedema than before induration sets in.

## 206 CHRONIC DIFFUSE NEPHRITIS WITH INDURATION.

*Bronchitis and chronic pulmonary œdema* occur in advanced stages as a result of cardiac insufficiency. For other clinical features see Primary Chronic Interstitial Nephritis.

*The Urine.*—We find the quantity of urine usually more abundant, specific gravity lowered, urea deficient, albumin still abundant, but not in such enormous quantity as before, casts not so numerous, fatty casts less frequent, and waxy casts present. There are also red blood corpuscles, hyaline casts and fatty epithelia present.

*Dangers.*—The dangers in this lesion are *cardiac dilatation and insufficiency*, resulting finally in dropsy, exhaustion or heart failure, and *uræmia*.

*Duration.*—The disease may last from one to three years.

*The Prognosis.*—Unfavorable.

*Treatment.*—See Primary Chronic Interstitial Nephritis.

## PRIMARY CHRONIC INTERSTITIAL NEPHRITIS.

*Synonyms.*—Contracting or contracted kidney, granular or red granular kidney, gouty kidney, chronic fibrous nephritis, granular atrophy or degeneration of the kidneys, red atrophy of the kidneys, chronic inter-tubular nephritis, third stage of Bright's disease.

*Definition.*—A form of chronic nephritis, often primary, of slow, insidious development, and in which the kidneys are hardened and often contracted to such an extent as to be evident at post-mortem to the naked eye.

*Pathologic Anatomy.*—*The Kidneys.*—Small, hard, granular. May be one-third normal size, or even not much larger than the thumb-nail. May weigh as little as 50 grammes (775 grains). Asymmetric kidney not rarely found. The kidney is embedded in abundant adipose tissue, which may adhere to the capsule. The *color* is usually reddish. The *surface* shows cysts.

*The Capsule.*—Firmly adherent; on removal tears the cortex.

*The Cortex.*—Highly granular, reduced in width, in some places absent, of mottled color with reddish striae or dots.

*The Pyramids.*—Reduced in size, but relatively increased compared with the cortex, forming the greater part of the cut surface. Contains bands of fibrous tissue extending from the cortex. Calcareous infiltrations and urate deposits may be found.

*Section.*—Shows, as above, the cortex diminished in size and the pyramids relatively increased. Cysts may be found involving the cortex principally, but may extend into medulla. The cut arteries stand out prominently and do not collapse. There is much fat in the renal pelvis.

Striated uric acid infarctions in the pyramids are a very characteristic mark of the gouty contracted kidney.

**Pathologic Histology.**—The features are an overgrowth of connective tissue and destruction of the glomeruli, principally in the cortex and especially marked in the labyrinth. There is marked increase of the stroma both in the cortex and pyramids, between the tubules, about the glomeruli and blood-vessels. The overgrowth is especially marked about the glomeruli and between the cortical tubules. The blood-vessels are thickened by endarteritis to a considerable degree, especially the smaller inter-tubular vessels.

The change in the capillaries is an arterio-sclerosis, but in the larger vessels it is an hypertrophy; the pathological condition is much different; in the capillaries new tissue is formed, and in the larger vessels there is an increase of all the normal tissues of the walls of the vessels.

**Etiology.**—In many cases there is no history of previous acute renal lesion; in a few a history of acute nephritis in childhood is obtainable.

I. *Hæmatogenous Causes.*—The principal cause seems to be *mild irritation of the kidneys* acting continuously over a long period of time, especially from *mal-assimilation* of food due to irregular habits or worry, or even worry alone; gout,

208 CHRONIC DIFFUSE NEPHRITIS WITH INDURATION.

the uric acid diathesis, alcohol, syphilis, malaria, lead poisoning and that from other substances. In a few cases diabetes, especially in early life, leads to it.

Elliott has pointed out that where there is chronic gastro-intestinal trouble, an increased amount of work is imposed upon the liver, with the result that the liver cells become gradually and progressively affected and eventually yield to irritation and prolonged over-functioning, permitting the poisons which reach them from the bowel, together with the products of disturbed hepatic function, to pass into the general circulation. The presence of these bodies in the blood disturbs vascular tension, and a high degree of renal irritation results from their elimination. He has called special attention to the insidious action of gastro-intestinal conditions resulting from chronic constipation, and to the effects of the toxines thus produced upon the kidneys, the disease being often far advanced before it was even suspected.

Osler thinks lithemia a common cause in this country, as is gout in England.

II. *Non-hæmatogenous Causes*.—Due to prolonged obstruction to the out-flow of urine from any cause, as stricture, enlarged prostate, hydro-nephrosis, cysts in the kidneys, or secondary to pyelo-nephritis, especially that of nephrolithiasis. Localized cases occur following the healing of abscesses, wounds, infarcts, or gummas in the kidney.

Clinically, we find lead, alcohol and uric acid three very common causes. Instead of uric acid the alloxuric bases may be the causative agents, according to Croftan, in all forms of nephritis with the exception of the form resulting from senile arterio-sclerosis.

It may appear after severe acute articular rheumatism, and may be found combined with chronic endocarditis, valvular heart disease, or with chronic arthritis not of gouty origin.

Herter thinks from 468 autopsies in which the weights of the kidneys were recorded that the belief that contracted

kidney results from alcoholic excesses rests on a very insecure foundation. He found 13 per cent. of the small kidneys in the non-alcoholic group, 8 per cent. in the moderately alcoholic, and less than 6 per cent. in the alcoholic.

On the other hand, he found 29 per cent. of the large kidneys in the non-alcoholic group, 45 per cent. in the moderately alcoholic group, and nearly 40 per cent. in the markedly alcoholic group.

These figures go to support the writer's clinical observation of the occurrence of the large kidney in the case of patients who have led lives in which drink was a feature.

*Gluttony* is recognized as a common history in cases of chronic interstitial nephritis.

**Occurrence.**—It occurs most commonly in males who are over forty years of age. Cases occur also in children and in young people. Guthrie reports seven cases in children, Goodno two, Milligan one with retinitis. The writer has seen it in the case of but few women, much less frequently than in men.

The patient is usually a man over forty years of age, belonging to the well-to-do classes, with previous condition of robust health and addiction to nitrogenous diet and good living. Has, perhaps, gout, or is of gouty ancestry, with apoplectic family history.

When the American humorist, Bill Nye, said that "Bright's disease was an aristocratic ailment," he must have had in mind this form of nephritis.

It may be present in persons who are apparently in good health, and its presence is not inconsistent in some cases with mental and physical activity. It is, as a rule, difficult to ascertain just when it began in a given case.

It is frequently associated with general arterio-sclerosis; it is probable that heredity has something to do with its development, as in some families it is as rife as tuberculosis in others.

The relation of the disorder to a cold, moist climate was

## 210 CHRONIC DIFFUSE NEPHRITIS WITH INDURATION.

pointed out by the late Dr. C. W. Purdy. The writer sees more cases of it in Chicago than of any other form of nephritis.

### THE CLINICAL FEATURES.

**Relation to Pathology.**—In this disease a previously healthy kidney is slowly attacked by some deleterious action, which results in the destruction of cell after cell of epithelium and islet after islet of tissue, together with partial replacement of the parts destroyed by a new formation of cicatricial tissue. We find, therefore, first: Renal insufficiency; second, rise in arterial tension now thought to be due to irritation from the uræmic poison; third, hypertrophy of the left ventricle, in a way compensatory, enabling the heart to do the extra amount of work required to keep up the excretion of urine; fourth, weakening and dilatation of the heart. As a result of the increased arterial tension and cardiac hypertrophy, which goes hand in hand with the process in the kidney, there is *polyuria*, by means of which a sufficient quantity of urinary solids is voided to enable the patient to live for perhaps a long period of time, the diminution in total solids per twenty-four hours being not great as long as the work of the heart is sufficiently good. In spite of this, however, minute quantities of toxins retained for a long time in the body may suddenly, by cumulative action, cause an acute uræmic attack somewhat similar to the cumulative action of lead or mercury. This probably explains why it is that persons previously regarded as healthy may suddenly die of uræmia or cerebral hemorrhage. Eventually if the patient escape death from acute uræmia, two things may happen: Either the left ventricle becomes weak or the process in the kidney reaches a point where not even the most vigorous efforts of the heart are sufficient to bring about compensation by way of polyuria. In the first case, the weakness of the heart is shown by the appearance of, first, more or less edema, finally a high degree of dropsy. In the second case, the various phenomena of chronic uræmia result from the

insufficient elimination of urinary solids. The patient, therefore, faces a triple-headed Cerberus which may destroy him: (1) the cumulative action of toxins, (2) the weakening of the heart, and (3) the extension of the process in the kidneys.

The arterial changes are progressive and the increased blood-pressure permanent. The hypertrophied muscular tissue is prone to degenerative changes, shows a greater tendency to exhaustion and weakness than the normal heart tissues, and it is but a question of time until increasing impairment of nutrition of the myocardium, with constantly growing peripheral resistance, results in failure of compensation and dilatation of the hypertrophied ventricles.

**Diagnosis.**—This is difficult to make from a few symptoms. Anders says: "A persistent albuminuria, together with presence of casts in the urine and the passage daily of a large quantity of clear, pale urine of low specific gravity, is sufficient for diagnosis."

The above is true enough, but the word "nightly" might with benefit be substituted for the word "daily."

The writer's attempt at shortening the phraseology of the diagnosis is as follows: A patient, man of middle age, who voids unaccountably more urine at night than by day (in the absence of pyuria), and who notices a loss of muscular strength, should be held to have chronic interstitial nephritis until, or unless, the contrary can be proved; and the diagnosis is rendered more certain by the discovery of albuminuria, cylindruria, and the signs of increased arterial tension.

**Onset.**—It has been truthfully remarked that an *albuminuria coinciding with headache, dyspepsia and a tense pulse* is always suspicious in a person over forty years of age. Add to this *muscular weakness*, which, in the writer's experience, is one of the earliest symptoms, and *rising at night to void a copious amount of pale urine*, and we have the cardinal features of the onset of this disease.

Increased arterial tension is the most important of the early symptoms.

## 212 CHRONIC DIFFUSE NEPHRITIS WITH INDURATION.

The excess of night urine over day is sometimes extraordinary. In one of the writer's cases the patient voided eight times as much urine from eight at night to eight in the morning as during the next twelve hours.

The onset presents usually some one or other of the following conditions :

1. The disease is latent so far as subjective symptoms go, the first of which may be sudden and unexpected uræmia or apoplexy.

2. The disease shows itself first by cardiac or vascular symptoms, dyspnœa, palpitation and slight œdema, or merely by increased pulse tension.

3. The first symptoms may be nose-bleed or those of retinitis.

4. The first symptoms may be those of a general disturbance, loss of appetite, pallor and physical weakness. (Strümpell).

5. The writer finds quite commonly among the first symptoms rising at night to urinate, the voiding of much pale, watery urine at night, and albuminuria, which, if absent at times, will usually appear after violent exercise, sexual excesses or hearty eating of meat with wine drinking, as at banquets. In these cases there is almost always more or less muscular weakness.

6. A congeries of symptoms may appear early, including headache, palpitation, bronchial cough, tinnitus aurium, muscæ volitantes, dizziness, malaise, anorexia, etc., which if accompanied by *an increase in pulse tension* are significant.

Whether albuminuria exists or not, insomnia, disorders of vision and digestive disturbances should direct attention to the kidneys, especially if the patient voids much pale urine at night. Disturbances of the nervous system may be marked and appear early. The patient's disposition may change, and he may become morbidly depressed, peevish, suspicious, impatient or even suicidal. Certain cases in which

peculiar variations in temperature suggest tuberculosis or malaria, with weakness, pallor and night-sweats, have been noticed.

Auditory troubles, vertigo, itching of the skin, muscular twitchings, cramps in the calves, especially at night, and sensitiveness to cold, especially of the lower limbs, are sometimes minor symptoms of the malady.

According to Eichhorst *suspicious symptoms* include the following: Palpitation of the heart, persistent headache, impaired vision, repeated epistaxis, persistent hoarseness, frequent vomiting, obstinate eczema, general itching of the skin. According to Anders, the disease may begin in seven different ways:

1. It may not show evidences until late in life, when the kidneys are badly degenerated.
2. It may show itself first through some complication or intercurrent malady as pneumonia or pericarditis.
3. More commonly the first conspicuous evidence is an attack of uræmia followed by recovery with more or less impaired health, and then another and severe attack which is either fatal or disabling.
4. Spasmodic dyspnoea may be the first symptom.
5. It may show itself by the gradual onset of periods of uncontrollable drowsiness by day.
6. The first evidence may be an attack of hemiplegia.
7. Sometimes the case is one of progressive loss of flesh and strength with a dry, harsh, wrinkled skin, and finally death from sheer exhaustion.

The writer thinks that the safest means of recognizing the disease early is careful study of the ratio of day urine to night in the case of men. An unaccountably large relative amount of night urine is always a suspicious sign if persistent. In the case of women this sign is, however, of much less value, as there are a number of conditions in which the amount of night urine is increased.

214 CHRONIC DIFFUSE NEPHRITIS WITH INDURATION.

**Course and Duration.**—The disease is an exceedingly irregular one, and may remain stationary for years. Often its progression is by skips and jumps. It is possible that some patients with strong hearts and unimpaired digestion may resist it for twenty years. In the writer's experience, however, it is uncommon for the patient to live more than seven or eight years after the diagnosis is rendered certain *by the urinary features*, viz.: Excess of night urine over day, deficiency of phosphoric acid, persistent presence of more or less albumin and a few casts. Intervals of several years of apparently good health are not at all uncommon. Cases in which albuminuric retinitis is established run a short course, seldom over three years, and usually less. In one case, however, which the writer saw, with Dr. J. H. Buffum, the patient lived more than five years after retinitis was found, and died from pyæmia following a carbuncle.

Absence of albuminuria, which is claimed to be observed in some cases, may be, perhaps, due to the fact that the diseased glomeruli have wholly ceased secreting, and that the urine comes wholly from healthy ones only. Absence of oedema may be due to the fact that the heart is as yet able to do its work sufficiently to prevent retention of water in the system.

There are a number of ways in which the disease may run its course; not less than ten distinct ways are known. For clinical purposes we may divide the disease into three periods.

I. *Early Stage.*—The patient may first complain of more or less weakness, insomnia, visual, digestive or auditory disturbances; he may be drowsy, and may have peculiarities of temperature. Although naturally of an amiable and sanguine disposition, he may become depressed, peevish, suspicious and impatient. No albumin as yet may be found in the urine, but the patient rises at night to urinate, and the night urine is paler and more copious than normal. Or there may be no features except slight muscular weakness and the nocturnal urination as above.

II. *Stage of Cardiac Hypertrophy.*—In this stage the symptoms are more pronounced, as follows:

*Symptoms of High Arterial Tension.*—Slow, hard, cord-like radial pulse (62 per cent. of the cases). Throbbing temporals, headache, hemorrhages (nasal, cerebral, cutaneous, into retina). Retinal changes are said to be found in 25 per cent. of the cases, but in the author's experience they are usually found late in the course of the disease.

*Symptoms of Hypertrophy of the Left Ventricle.*—Palpitation, displacement of apex beat downward and outward, increased strength of apex beat, increased area of cardiac dullness, especially to the left; accentuation of the second sound in the second right costo-sternal interspace (80 per cent. of the cases).

Headache, giddiness, tinnitus aurium, general congestion, oppression, dyspnoea without lung trouble apparent, asthmatic attacks, angina, shortness of breath on exertion, consciousness of violent beating of the heart.

NOTE.—In this stage exposure or excess may bring on hemorrhages, acute uræmia, or inflammation of internal organs, as follows: Lobular pneumonia in 13 per cent. of the cases; pleurisy; pericarditis; bronchitis common, and persistent winter cough; peritonitis rarely.

Hypertrophy of the left ventricle without valvular disease is of the greatest importance in directing the attention to the kidneys in a doubtful case. It may be absent in weak, cachectic patients.

Reduplication of the first sound is not uncommon, while the second sound as heard over the aortic area is accentuated and has a peculiar ringing quality. A systolic murmur heard at the apex and transmitted to the left may develop later.

While the pulse is usually slow in the stage of cardiac hypertrophy, it may become rapid and unusually full and hard when extension of the process in the kidney renders even the most vigorous efforts of the heart insufficient to keep

up sufficient urinary excretion. The first sound of the heart is usually, however, indistinct.

Broadbent claims that one of the early indications of arterial pressure and changes in the blood-vessels and the heart is the reduplication of the first sound, best heard in the inner side of the apex.

**Use of the Sphygmograph.**—This instrument, as Cabot says, is a fascinating little toy, but in the present form almost devoid of practical usefulness because almost any type of tracing can be obtained from the normal pulse by varying the pressure.

**Cerebral Hemorrhage.**—In the stage of cardiac hypertrophy cerebral hemorrhage is not uncommon, occurring in perhaps 16 per cent. of all the cases. Southey observed it in 45 per cent. of 358 cases, and in 111 deaths from apoplexy in St. George's Hospital chronic interstitial nephritis existed in fifty-five.

**Clinical Summary.**—*Clinically*, however, we find in the stage of cardiac hypertrophy that the patient's subjective symptoms are chiefly *headache*, due to active cerebral hyperæmia; *vertigo*, due to the same cause, and *nose-bleed*.

The nutrition of the patient may not be greatly changed if the disease progresses gradually, and corpulence may be present. In younger patients only there may be pallor.

In later stages, however, the patient is emaciated and of sallow, often cyanotic, complexion.

**The skin** is sometimes affected. Samuel West has noted erythema, pityriasis, dermatitis exfoliativa, general eczema, a discrete papular eruption, sometimes lichenous, sometimes resembling chronic urticaria.

**The Urine in the Stage of Hypertrophy.**—The features are polyuria, night urine equal to or more usually exceeding day, deficiency of urea, marked deficiency of phosphoric acid; albumin small, sometimes traces only, or absent; casts few, hyaline or absent.

Polyuria is not invariably present. On some days the urine may be sub-normal in quantity, but the general tendency is to void more urine than normal.

*Quantity in Twenty-four Hours.*—Usually, in earlier stages, two or three times the amount normal for the patient, from 2500 to 3000 c.c., 80 to 100 ounces at most. Occasionally 4000 or 5000 c.c. are passed, especially if patient drinks freely. In one of the writer's cases the patient voided 5330 c.c. of a specific gravity of 1.001.

*Urea.*—Deficient, both relatively and absolutely.

*Phosphoric Acid.*—Greatly decreased, relatively and absolutely. Characteristic. Ratio of urea to phosphoric acid may be above 12 to 1.

*Chlorides and Sulphates.*—Decreased. Chlorides less than other constituents.

*Color.*—Pale, transparent when fresh; hazy at end of twenty-four hours.

*Specific Gravity.*—Varies from 1.005 to 1.010, and seldom goes above 1.012 until stage of heart failure, when it may rise to 1.018 or 1.020. *The specific gravity of the day urine may be higher than that of the night.*

*Albumin.*—As a rule, small in quantity (less than one on Esbach tube, less than ten per cent. bulk by the ferrocyanic method in centrifugal machine, five minutes at 1000 revolutions per minute). In acute intercurrent attacks, uræmic attacks, or febrile attacks, increases.

May be absent from night urine and present only in traces in day when heart not dilated. May perhaps be absent altogether at times, especially when not in last stage, and when the disease is of vascular origin, or when cardiac symptoms (not dilatation) predominate over renal ones.

*Casts.*—Usually two or three hyaline casts, occasionally dotted with epithelia or with fine granules, are all that are noticed except during acute uræmic attacks.

It is said that fatal uræmia may take place when the urine

## 218 CHRONIC DIFFUSE NEPHRITIS WITH INDURATION.

is free from albumin and of normal specific gravity, but the writer rarely finds albumin absent in this disease after exercise, sexual intercourse and banquets. It is frequently the case, however, that no albumin can be found in the urine voided on rising in the morning, hence the practice so common of testing only the morning urine should be deprecated.

*Stage of Cardiac Dilatation.*—When dilatation succeeds and compensation fails, any or all the symptoms of chronic endocarditis or myocarditis may appear.

Extension of cardiac dulness to the right, possibly systolic souffle at apex, pulse weaker, more frequent, irregular; dyspnoea prevalent; dropsy sets in, beginning at the feet, extending upward, and perhaps involving abdominal cavity; cirrhosis of the liver, sub-jaundiced hue of skin, haemorrhoids, obstinate diarrhoea, watery stools at night. œdema of the lungs or larynx may be present.

*Nutrition affected* and patient loses flesh, has dry, withered skin, hard, rigid hair, drawn features, sunken face, sub-normal temperature, loss of sexual desire and power. (In earliest stages sexual irritation and increased desire.) Anxiety and *wakefulness at night* are frequent.

*Chronic uræmic symptoms* now pronounced: Dyspnoea, often asthmatic; gastro-intestinal symptoms; nausea, vomiting, diarrhoeal attacks; cutaneous symptoms, intolerable itching and burning of the skin, persistent eczema; general muscular weakness, cramp, numbness, pricking of the skin.

In this stage the dyspnoea is due partly to pulmonary congestion, diffuse bronchitis, pneumonia and hydrothorax. Attacks of asthma may be due either to cardiac weakness or to uræmia, and are sometimes associated with signs of acute pulmonary œdema with expectoration of a large amount of foamy, serous sputum often tinged with blood.

The tongue is generally coated. It may be red, dry and cracked, or moist and glazed, or covered with a brownish scum, or furred and foul.

Failure of cardiac compensation in the late stage is often indicated by an unaccountable diminution in the quantity of urine before severe uræmic symptoms, as above.

*The Urine in the Last Stage.*—Quantity may be, and usually is, less than normal ; albumin may increase in quantity (to second mark on Esbach tube, 20 to 30 per cent. bulk ferrocyanic); casts more easily found, including a few granular. The specific gravity is higher and the color darker than in other stages.

In this last stage apathy and semi-torpidity of physical and mental powers occur. Coma is more likely to take place than convulsions.

It must be carefully understood that the disease may not plainly show its progression, through the three stages above described. Patients may either die of acute uræmia before reaching the third stage, or their condition may not be suspected by subjective symptoms or ascertained before the last stage is reached. It is surprising how rapidly the third stage may progress to a fatal termination. The writer has seen cases in which the duration of this stage was apparently not three months, and prior to this time the patient was about his business as usual.

## VARIOUS MANIFESTATIONS OF THE DISEASE.

These are uræmia, retinitis, internal hemorrhages, and inflammations of internal organs.

**Acute Uræmia.**—In acute uræmic attacks there may be giddiness, drowsiness, muscular twitchings, periodical convulsions or coma ; the perspiration may be sticky and urinous; there may be a strong odor of the urine in the breath and to the body. Violent headaches may be noticed of uræmic origin, partly dependent on passive cerebral hyperæmia or arterial anæmia of the brain. These headaches not infrequently precede convulsions.

## 220 CHRONIC DIFFUSE NEPHRITIS WITH INDURATION.

Acute uræmic attacks may come on at any time in the course of the disease and are sometimes the first subjective signs of it.

**Retinitis.**—This may come on at any time in the course of the disease, in which it is more frequent than in any other renal lesion. It may appear very early in the disorder. It is said to occur in from 15 to 25 per cent. of all cases of chronic interstitial nephritis, but it is possible that it is more frequent even than these figures indicate. Milligan reports a case of chronic interstitial nephritis with retinitis in a boy of seven.

The cardinal features of albuminuric retinitis are yellowish spots around the macula lutea and larger spots in the neighborhood of the optic papilla. In addition there is frequently also seen swelling of the optic papilla, retinal haemorrhage, venous hyperæmia, and tortuous veins.

**Internal Haemorrhages.**—These are not so common as retinitis, but are clinically important signs of the presence of the disorder. They are due either to increased arterial pressure, as in elderly persons with arterio-sclerosis, or to abnormal weakness in the blood-vessels due to defective nutrition, as in younger patients. Haemorrhages into the brain causing mild or severe apoplectic attacks are most common; the latter may pass off without much injury to the patient or may result in hemiplegia or in death.

Haemorrhages in the inner surface of the dura mater (haematoma) also occur. The most frequent haemorrhage is nose-bleed. It is sometimes stubborn and has been known to cause death.

Besides these there may be haemorrhages in the skin, stomach, intestines, and lungs; a sort of haemorrhagic diathesis may in some cases develop.

**Inflammations of Internal Organs.**—These are usually present some time in the course of the disease, as in all renal lesions. Pneumonia is the most frequent and important; in some cases it is croupous, in some lobar, and in others the diffuse lobular pneumonia peculiar to nephritis.

Inflammations of mucous membranes manifest themselves by chronic bronchitis, gastritis, gastric and intestinal catarrh partly due to congestion partly to irritation.

Inflammation of serous membranes occur, as pleurisy and pericarditis. Inflammation of the skin may be manifest by presence of eczema.

**Differential Diagnosis.**—Primary chronic interstitial nephritis must in the onset often be differentiated from an attack of dyspepsia, gastro-enteritis, bronchitis, or cerebral disease. The condition of the urine and the increased pulse tension are the cardinal points for differentiation.

Chronic interstitial nephritis must be differentiated from various nervous diseases, among which are neurasthenia and chronic myelitis, since the condition of the urine of those diseases sometimes resembles that of chronic interstitial nephritis, a fact which seems to have been overlooked by our authors. The differential diagnosis from mild cases of neurasthenia is difficult, but age of the patient and previous history of nervous prostrations may distinguish. Chronic myelitis may be distinguished by the symptoms paraplegia, anaesthesia, hyperaesthesia, and the like. Chronic interstitial nephritis must be distinguished from certain cases of myocarditis, the urine, pulse and symptoms being alike when the patient with myocarditis is an alcoholist or suffers from hunger. A dilated and hypertrophied heart is, moreover, essentially in a condition of chronic myocarditis. History of high tension with loud second sound and symptoms of chronic uræmia serve to distinguish the two diseases, since weakness of the heart and feeble sounds are characteristic of myocarditis.

**NOTE.**—In the stage of cardiac dilatation uræmic symptoms and the urine serve to distinguish chronic interstitial nephritis.

When chronic nephritis and chronic myocarditis coexist, and both kidneys and heart are inadequate, it is difficult to decide which is the primary condition.

Babcock lays stress on the following points: If hypertrophy

## **222 CHRONIC DIFFUSE NEPHRITIS WITH INDURATION.**

and dilatation affect the whole heart, if pulse tension is high and sustained out of proportion to the degree of cardiac feebleness and of peripheral arterio-sclerosis, and if the urine is scanty and deficient in solids with or without albumin, the renal disease is probably the primary or predominant one. If, on the other hand, cardiac enlargement is chiefly in the left heart; if the peripheral vessels show marked sclerosis; if the pulse tension is low; if the urine, scanty in amount, is of high specific gravity with or without albumin, the condition of the heart is more serious and threatening than that of the kidneys.

It must be remembered that chronic interstitial nephritis is a disease in which certainty as to the diagnosis is to be had almost wholly from examination of the urine alone. If albumin is not present, there will be difficulty in distinguishing it from myocarditis, idiopathic hypertrophy of the heart and certain cases of intestinal auto-intoxication, the latter quite common among constipated women. The presence of albuminuria after exercise, sexual intercourse and banquets is, in the writer's experience, a help in the diagnosis.

Primary chronic interstitial nephritis may be distinguished from secondary by the history of the case and the age of the patient. In secondary chronic interstitial nephritis the patient is usually between twenty and forty years of age, and has a history of previous chronic diffuse nephritis without induration. In primary chronic interstitial nephritis the patient is usually over forty years of age, and lacks history of previous chronic diffuse nephritis without induration. A previous history of good health is quite commonly found in primary chronic interstitial nephritis, but never in secondary. Moreover, in the secondary disease the urine is abundantly albuminous, and the sediment contains blood corpuscles and numerous casts, mostly hyaline and granular, together with fatty epithelia.

Chronic interstitial nephritis must be differentiated from hysterical polyuria. The urine in the former disease keeps its

low specific gravity in spite of decrease of daily quantity below the average normal.

Primary chronic interstitial nephritis is distinguished from chronic diffuse nephritis without induration by the absence of general dropsy till late, the small quantity of albumin, and the few casts.

The large amount of albumin and rareness of uræmia serve to distinguish lardaceous (amyloid) disease from chronic interstitial nephritis.

In senile atrophy of the kidney and atrophy due to chronic endocarditis we find urine similar to that of chronic interstitial nephritis. The diagnosis rests upon the progressive development found in chronic interstitial disease, and the probability that in the other cases albumin and casts have been found for many years in individuals seemingly in good health.

Chronic interstitial nephritis must be differentiated from diabetes insipidus. In the latter disease a trace of albumin may be found in the urine, together with polyuria and deficiency of solids; but the polyuria is usually excessive, no casts occur, and the cardio-vascular and uræmic symptoms of chronic interstitial nephritis are absent.

The differentiation of *passive congestion* of the kidneys from chronic interstitial nephritis is of importance. The following will be of help in the diagnosis :

#### THE URINE OF

##### *Chronic Renal Hyperæmia.*

##### *Primary Chronic Interstitial Nephritis.*

Oliguria.	Polyuria.
Percentage of solids (grains per ounce) increased.	Percentage of solids decreased.
Color increased.	Color decreased.
Albumin small.	Albumin small.
Casts few, hyaline.	Casts few, hyaline.
Urates and uric acid in sediment.	No crystalline sediment except a few oxalate crystals.
Blood corpuscles in sediment.	No blood corpuscles, unless cystic disease.

## 224 CHRONIC DIFFUSE NEPHRITIS WITH INDURATION.

### SYMPTOMS OF

<i>Chronic Renal Hyperæmia.</i>	<i>Chronic Interstitial Nephritis.</i>
Valvular diseases without hypertrophy.	Hypertrophy without valvular diseases.
Weak, thready pulse.	Full, hard pulse.
Dropsy, hydrothorax, etc.	No dropsy till late.
No uræmia.	Chronic uræmia.
No rising at night to urinate.	Rising at night.
No visual disorders.	Visual disorders.

In the stage of *cardiac dilatation* the comparatively light color of the urine and deficiency of solids with increase in albumin serve to distinguish from passive renal hyperæmia, in which oliguria is accompanied by urine of deeper color with higher percentage of solids, but with a small quantity of albumin.

It must be admitted, however, that there is sometimes considerable difficulty in differentiating. In the writer's experience, if the patient is not under the influence of diuretics, the scanty urine in passive hyperæmia is usually 1.025 in specific gravity or higher, and the color red or even darker; a deposit of urates is more common also in hyperæmia than in contracted kidney in the stage of cardiac dilatation. Casts are somewhat more plentiful also in the renal cases than in the cardiac ones, and the percentage of urea not usually above 25 gm. per liter, while in cardiac cases it may rise to 30 gm. or more per liter.

The history of the patient is often serviceable in the differential diagnosis. If the patient has had in the past the habit of voiding a relatively large amount of pale urine at night, and if there have been uræmic symptoms, especially transitory visual ones or more or less persistent auditory ones, the chances favor the diagnosis of renal disease rather than cardiac. There is in the renal cases also a general tendency toward abnormally loud aortic second sound of the heart. Moreover, the case is far less amenable to treatment when renal than when cardiac, as the physician will soon find out after a week or two of trial.

When chronic interstitial nephritis is first seen during sudden uræmic or apoplectic attacks, it may be extremely difficult to distinguish it from acute cerebral disorders.

Chronic interstitial nephritis must be differentiated from auto-intoxication of intestinal origin, especially in constipated women. The following paper by the author will help in the diagnosis:

One of the questions which frequently comes up is whether the patient has contracting kidney or simply auto-intoxication of intestinal origin. In the case of men, it is seldom that the answer cannot be soon given; but when the patient is a woman, greater difficulty is experienced in solving the problem. Take, for example, a case like the following, one of many which the writer has seen:

Patient a woman, 45 years of age. Urine in twenty-four hours, 72 fl. oz.; night urine exceeds day; specific gravity, 1.009; reaction neutral; urea per twenty-four hours, 150 grains; phosphoric acid, 24 grains; uric acid, 3½ grains; no albumin; no sugar; sediment of the usual epithelia; no casts; no crystals; no pus; no blood; no connective tissue.

More than one such case has been referred to the writer with the diagnosis of contracting kidney already made by the attending physician. Now, it is true that in contracting kidney we find urine of such quantitative composition; but, in the writer's experience, if the urine voided at different times in the twenty-four hours be carefully examined, either a trace of albumin or several hyaline casts per 15 c.c. of urine, or both, will be found, if it is really a case of contracting kidney. In the case above described no albumin and no casts could be found at any time of day. Furthermore, if no albumin or casts can be found after the patient has eaten as heartily as possible of meat, and has also been subjected to the test of as severe exercise as advisable, then the presence of contracting kidney becomes improbable, especially if cardio-vascular and retinal changes are absent.

**226 CHRONIC DIFFUSE NEPHRITIS WITH INDURATION.**

It will not be out of place here for the writer to inveigh against the too frequent practice of testing only the urine voided on rising in the morning. If the patient is merely told to bring a sample of urine for examination without further directions, the chances are very great that he, and especially she, will bring the urine voided on rising in the morning, which, even in well-advanced cases of contracting kidney, may contain neither albumin nor casts. A classical case of this kind the writer once saw with Dr. C. G. Fellows. After Dr. Fellows had made the diagnosis of retinitis albuminurica, and after careful examinations of the twenty-four hours' urine had shown the qualitative and quantitative indications of contracting kidney, the writer examined the urine voided on rising in the morning, and found nothing but a urine of poor quality, without either albumin or casts, and this, too, but a few weeks before death from typical uræmia. Mild, slow cases of contracting kidney are to be found in which albumin and casts may be absent in the forenoon. Such patients may in the earlier stages be accepted by life insurance examiners whose hours are early in the day. But the writer has yet to see a case of contracting kidney, or one which in a few months, at any rate, has developed into a recognizable case of contracting kidney, in which albumin or casts could not be found at some time in the day, especially after exercise or after hearty eating of meat. In men whose cases are at all doubtful it is the writer's habit to request the urine for examination to be collected during the twenty-four hours following a "stag" dinner or banquet. Any doubts about the case can usually be set at rest by examination of urine thus collected. The same may be said of urine voided after excessive sexual intercourse, with the observation, however, that such urine in the case of young men may contain albumin in small quantity (without casts or other evidences of renal lesion), probably referable merely to temporary renal congestion.

But to return to the case of women. Here the condition is more puzzling. We find women with impaired health, unable to attend to their usual duties, occupations, or pleasures, on the verge of nervous prostration, collapsing entirely in hot, humid weather, voiding a relatively great quantity of pale urine at night, and not excreting 200 grains of urea in all during the twenty-four hours. Most careful examination of the urine fails to discover either albumin or casts at any time of day. Let it be understood, however, that the so-called delicate tests for albumin are excluded. The writer has shown, in an article in the New York *Medical Times*, that several of these tests (Spiegler's and the trichloracetic especially) are subject to grave error from presence of alkaline carbonates. Now, it is in just such urine as that voided by women described above that we can find a white ring with some of these delicate tests, due to presence of these same alkaline carbonates. Add to such urine 10 per cent. of its volume of an 80 per cent. solution of calcium chlorid (pure crystals), filter, test again, and there is no white ring to be found, because calcium carbonate has been precipitated and filtered off, and albumin is absent. When the writer refers to absence of albumin, it is understood that boiling, followed by cautious addition of acetic acid (50 per cent.) drop by drop, shows no readily perceptible haze, and the cold nitric acid test performed by means of the albumoscope shows no white ring at all at the juncture of the fluids against the black background.

Moreover, repeated microscopical examinations of the urinary sediment, with and without centrifugal sedimentation, reveal no casts, or, at most, not more than one small hyaline cast, occasionally found.

When such results are obtained by examination of the urine, and when evidences of cardio-vascular changes or retinal changes are absent and typical uræmic manifestations are lacking, how can we make a diagnosis of contracting kidney?

On the other hand, it is true that contracting kidney is a

most mysterious and insidious malady, and that it requires no small courage to deny its existence in the case of any obscure ailment in a person over forty years of age. The writer, however, believes that in the case of women this lesion is not common. Hundreds of women with urine like that of the analysis described in the beginning of this article have presented themselves from time to time for examination, and the writer is unable to recall a single case in which subsequent developments have shown indubitable proof of the presence of chronic renal lesion. Even supposing that a dozen of them have died of uræmia, unknown to the writer, this would be a small proportion compared with the number which the writer positively knows to be alive and still devoid of any tangible evidences of contracting kidney after a period of several years. There is no question whatever, so far as the writer's experience goes, that contracting kidney is as uncommon in women as it is common in men.

On the other hand, the frequency of ovarian and uterine diseases, constipation and fecal impaction, in the case of women, have much to do with the development of what used to be called "renal insufficiency." The observations of Lucas-Championnière on the influence of ovarian diseases on the excretion of urea in women have already been quoted by the writer ("Manual of Urinary Analysis," 3d Ed., page 82). The effect of fecal impaction on the urine is well shown by the following case: Patient, a woman, 43 years old, on the verge of nervous prostration, without organic lesion so far as could be discovered. Examination of the urine revealed the following:

Total urine for 24 hours, 34 fl. oz.; night urine, 22 fl. oz.; day urine, 12 fl. oz.; specific gravity, 1.014; total urea, 177 grains; total phosphoric acid, 19 grains; total uric acid, 1 grain; no albumin; no sugar.

Sediment: The usual vaginal epithelia; no casts; no crystals; no pus; no blood.

No albumin and no casts could be found in the urine of this patient at any time of day. Cardio-vascular and retinal changes were absent. Her extreme weakness, however, and tendency to collapse in hot, humid weather bespoke some kind of toxæmia.

The writer refused to make a diagnosis of contracting kidney, and ordered vigorous colon flushing, which was most conscientiously done, and repeated until an immense mass of impacted feces was removed. Now, what was the result? After the colon flushing was over, examination of the 24 hours' urine showed the following changes:

Total urine, 26 fl. oz.; day urine, 16 fl. oz.; night urine, 10 fl. oz.; specific gravity, 1.015; urea, 279 grains; phosphoric acid, 32 grains; uric acid, 1 grain. Otherwise as above.

This is not the first time the writer has seen a re-establishment of the normal excess of day urine over night and an increase in urea follow colon flushing and removal of impacted feces. The patient is still alive, fairly well, and shows no signs of contracting kidney. Further examinations of the urine show neither qualitative nor quantitative deviations from normal worth noticing. The last analysis, one year after the discovery and removal of the fecal impaction, showed three hundred grains of urea in the twenty-four hours' urine.

In answer, then, to the question, Have we a case of contracting kidney, or not? the writer submits the following conclusions:

1. In the case of men over forty voiding urine of poor quality, with night urine exceeding day, the presence of contracting kidney is exceedingly probable; and urine voided after banquets, exercise, or sexual intercourse, is likely to confirm the probability by showing presence of albumin and casts. Later the presence of cardio-vascular or retinal changes confirms the diagnosis, in case these are absent in the beginning.

2. In the case of women over forty voiding urine of poor quality, even if the night urine exceeds the day, the presence

230 CHRONIC DIFFUSE NEPHRITIS WITH INDURATION.

of contracting kidney is improbable if, as is so often the case, neither albumin nor casts can be found at any time of day—especially improbable if ovarian and uterine diseases are present, and where milk diet increases urea to normal. Contracting kidney can probably be excluded by the return of the urine to permanent normal quantitative conditions after flushing of the colon and removal of impacted feces, when also, of course, cardio-vascular or retinal changes are not to be found. (*The Hahnemannian, January, 1902.*)

On the other hand, it cannot be denied that gastro-intestinal disturbances, and especially chronic constipation, by imposing greater work on the liver, may be a fruitful cause of irritation of the kidney, and that, if the kidney is already diseased, these conditions undoubtedly aggravate the renal trouble.

**Prognosis.**—The disease is incurable, but may be subject to long periods of remission. If symptoms are of chronic uræmia (headache, dyspepsia, visual disturbances), without cardiac weakening, disease may be checked for years by diet and medication—in extreme cases twenty years. Suitable climate may help. After the heart begins to fail, life is usually prolonged not more than a few years at most. After marked cardiac dilatation takes place it is a question, as a rule, of months, or even weeks.

Death sometimes occurs unexpectedly in earlier stages, when the patient is apparently enjoying a remission, from sudden cerebral haemorrhage or acute uræmia, or more gradually from acute inflammation of serous membranes, lungs, or intestines.

Convulsions and apoplectic seizures are often fatal; unfavorable signs are persistent vomiting and diarrhoea, retinitis, delirium and coma.

**Dangers.**—The chief dangers in the course of the disease are acute uræmic attacks and haemorrhages. Both may take place at almost any time, but haemorrhages within the retina, brain or internal organs are rather more common after cardiac hypertrophy is established.

Excesses, over-exertion, or exposure may be followed by pneumonia, dysentery, acute uræmia, pleurisy, œdema of the lungs and peritonitis, the latter less commonly. It is doubtful whether endocarditis is a consequence of the disease. In the stage of cardiac dilatation, uræmia, heart-failure and exhaustion are the chief dangers ; the patient may also succumb to secondary pneumonia, which, in this stage, may prove rapidly fatal.

Among other dangers frequently noticed by the author is that from accident, the result of vertigo. The patient may be badly injured as a result of a fall when seized with vertigo. In one of the writer's cases death soon followed concussion of the brain from such a cause.

Pericarditis is a grave complication ; it may produce no symptoms and only be discovered accidentally when the friction sounds are heard.

#### THE TREATMENT OF CHRONIC INTERSTITIAL NEPHRITIS.

Modern writers are agreed that the disorder is essentially incurable, hence the necessity of prophylaxis.

**Prophylaxis.**—Avoidance of meat and highly-seasoned foods and rich gravies, regular ingestion of fluids, avoidance of alcoholic beverages, malarial localities, and irregular modes of life.

Overworked men and indolent, luxurious women should form the Turkish-bath habit in early middle life, especially if of gouty ancestry, but chilling after the bath is said to be a frequent cause of this disease.

Climatology as in chronic diffuse nephritis without induration.

The writer suggests that instead of taking Turkish baths in the summer time, the patient visit the mud-baths.

**Principles of Treatment.**—These are first to guard the kidneys against all sources of irritation, and, second, to lessen

**232 CHRONIC DIFFUSE NEPHRITIS WITH INDURATION.**

the strain on the heart. The first is accomplished, so far as possible, by diet and great care of the skin and bowels, the second by avoidance of over-exertion, excess, mental strain, together with moderate, methodical exercise, especially for the corpulent.

The conditions which confront us are thickened and inelastic arteries, which are constantly subjected to the strain of a heightened tension, and a hypertrophied and sensitive heart muscle. Thus the patient is exposed to the risk of rupture of the degenerated vessels on the one hand, and failure of the hypertrophied heart on the other.

**Regimen.**—Woolens next to the skin at all seasons of the year, and special care to avoid exposure and over-exertion or excess. Systematic out-door exercise graduated to the strength and habits of the patient, hence out-door life in a mild, equable climate, like Southern California, of the utmost benefit. Skin and bowels to be attended to. Warm clothing and frequent warm baths, with care to avoid subsequent chilling. During stage of cardiac hypertrophy patient must be particularly cautious about running or over-exertion.

Warm baths or salt baths with daily sponging of the whole body with brandy or vinegar are helpful.

When the heart begins to fail rest is necessary, but massage and passive movements may help prevent impairment of nutrition.

**Climatology.**—Patients may derive benefit from sea voyages, residence in Southern California, Southern Europe, or near the African desert, as at Helouan. But in the last stage of cardiac dilatation, or where for any reason the end seems near, *keep the patient at home* where he can be made comfortable and receive the attention of his friends and family.

**Diet.**—Owing to the long continuance of the disorder milk diet is not possible, nor is it useful except perhaps during acute intercurrent attacks, when Vichy and milk are useful. Alcoholic drinks are forbidden, especially beer and cham-

pagne. The diet should be farinaceous as far as possible, with sufficient fish, chicken, and occasional meat to keep up the strength. The patient should drink sufficiently of liquids to keep the urine a little above three pints daily; but when there is already polyuria, it is doubtful whether copious ingestion of mineral waters is of value.

During stage of heart failure diet should be more liberal and a little meat allowed daily.

The theoretical allowance of meat is five ounces daily. The following paper by the author may be serviceable in the treatment of the disease :

#### DIET AND CHRONIC INTERSTITIAL NEPHRITIS.

In those who have no obstruction to the free flow of urine the foremost cause of chronic interstitial nephritis is now thought to be long-continued irritation of the kidneys from the passage through them of the products of imperfectly digested food. The disease is notoriously common among those who "live well," as the expression is. Inasmuch as those who "live well" consume a great deal of meat, we have concluded that it is the meat which is the cause of the nephritis. But if those who "live well" be watched carefully, it will be observed that in addition to eating meat they eat and drink a good many other things. And after they have eaten too much meat plus too many other things they depress the nervous system by smoking strong cigars, by late hours, business tension or worry, or excessive venery. Now, it is admitted, I believe, that it is harder to digest meat when at the same time sugars and starches are eaten freely. The person may be able to manage the sugars and starches without an attack of "indigestion," but at the expense of imperfect digestion of the meat. This may possibly explain why it is that persons who boast that they have always been able to digest "anything" finally succumb to contracting kidney.

The kidneys in such cases have suffered in silence, as is

**234 CHRONIC DIFFUSE NEPHRITIS WITH INDURATION.**

their wont, for years. Proof of the innoxious character of nitrogenous food alone without sugars and starches is to be had from observation of diabetics in whom, as a rule, nitrogenous diet fails to produce chronic interstitial nephritis. We must reason, therefore, that it is not the eating of meat alone which causes contracting kidney, but the imperfect digestion of it from various causes coupled with imperfect elimination from various other causes.

A healthy man may eat a pound or two of beef in a day with impunity, regardless of the theoretical inability of the kidneys to dispose of the waste matter if, at the same time, he looks after the ventilation of his rooms, sleeps his healthy quota of hours, drinks water only and that in plenty, exercises moderately in the fresh air, avoids sweets and excess of starches, and does not depress his nervous system by excessive smoking, worry or venery. That this is not an idle statement may be proved by the writer's own experience of fifteen years or more of beef eating, three times daily, with not an hour missed from his profession because of illness during the entire period nor a single attack of headache. On the other hand, a single so-called "banquet" of a dozen courses of more or less indigestible food, including a good deal of meat, the smoking of several cigars, and the drinking of various wines, may immediately give rise to all the phenomena so clearly described by Dr. Haig, in his interesting book on Uric Acid. Or if the eating of meat be coupled with the drinking of beer similar ill-effects may be noticed. Chilling of the surface of the body under such circumstances leads to repeated congestions of the kidneys, and is undoubtedly a factor of importance in the etiology of contracting kidney, a disease of the temperate zone in localities where sudden changes in the weather are common.

The question of what happens to the kidneys of those who eat more meat than the theoretical allowance of five ounces may be answered as follows: If the eating of meat be properly

conducted without the concomitants mentioned above, fifty ounces of urine in the twenty-four hours will contain five hundred grains or more of urea and ten grains, or even more, of uric acid, and the kidneys be none the worse for it. If, on the other hand, the eating of meat be improperly conducted, the amount of urea may be large enough, but the quantity of uric acid will fluctuate widely, a trace of albumin appears, sooner or later becoming two to five per cent. bulk, and which, after "banquets," is especially noticeable. The individual in the latter case first notices loss of muscular strength, and then headaches or persistent neuralgias. Later he has either acute uremic attacks or the cardiac and vascular symptoms now so well recognized as phenomena of chronic interstitial nephritis.

The dietetic prophylaxis of contracting kidney then narrows down from a practical standpoint to limitation of the amount of meat ingested, or to care not to overload the stomach with sweets and starches in the case of individuals who eat meat freely. It is difficult, not to say impossible, to convince the average layman in good health that he is eating anything which in time may kill him. He is, however, more or less open to conviction along the line of moderation. It often happens that owing to the wretched cookery, unfortunately almost universal in the United States, meat is about the only dish upon which a man doing brain-work can nourish himself. It is idle, therefore, to expect a person at the mercy of a Swede servant girl to starve himself to death in order to avoid the remote contingency of contracting kidney. But if physicians would insist that a person obliged to live largely on meat should avoid sweets and excess of starches and drink plenty of water, some practical good might be accomplished.

When once the disease has become established the problem of diet is serious. In cases where headaches are severe the writer appears to have demonstrated that there is a relation-

**236 CHRONIC DIFFUSE NEPHRITIS WITH INDURATION.**

ship between meat-eating and the headaches, and believes that no meat at all should be allowed patients subject to severe attacks of cephalalgia. In other cases the amount of meat to be allowed can in general be guessed at by the amount of albumin in the urine and the symptoms of the patient. For example, the writer recalls one case in which the amount of albumin, for some time merely a trace, rose to two per cent. bulk during the twenty-four hours following hearty eating of beefsteak at dinner. Milk as a steady diet in chronic interstitial nephritis is not to be thought of, as it fails to nourish the patient properly. On the other hand, buttermilk, made from good whey, is probably of great value as an addition to the diet. The writer thinks that not enough attention has been paid to buttermilk as an article of diet in contracting kidney. The patient who lived the longest of any under the writer's observation subsisted almost wholly for years on buttermilk. This same patient broke his oculist's record for length of time of survival after onset of albuminuric retinitis, and, although he finally died, the cause of death was pyæmia from carbuncle. Other articles of diet usually allowable are oysters, fish, sweetbreads, bread and butter, cereals, and not too acid fruits. Chicken should be fresh-killed and well-cooked. In the writer's experience nothing is more common on the tables of Americans than tough chicken, and it is exceedingly doubtful whether as such it is allowable. When meat in small quantity appears to do no harm, a small, tender, well-cooked mutton-chop is the desideratum; the leathery article usually in evidence is not to be thought of. Beans and peas are not only nitrogenous, but flatulent, and should be forbidden. An excellent dessert is baked apple, especially in the case of those inclined to constipation. Those who cannot eat apples on account of difficulty in digesting them should have them baked for not less than three hours, until they are almost a jelly. The action of them even then on the bowels is marked. In the matter of fruits, such as grapes

and peaches, too much care cannot be exercised in selecting ripe ones.

In fact, the question of diet is, in the writer's opinion, quite as much one of how the patient's food is selected and cooked as it is one of what he eats. Poor cookery kills more Americans in the long run than almost anything. Without wishing to disparage the value of time spent in the study of bacterial diseases the writer regrets that an equal amount of time is not given to the study of diseases which may be prevented by closer attention to the selection and cooking of ordinary food.

In general, the diet should consist of lean meat once daily, the remainder of the diet consisting of vegetables, green fruits, light farinaceous foods and Battle Creek foods. Tea, coffee, cocoa and the natural mineral waters are allowed. During attacks of indigestion, milk is the proper diet; buttermilk, koumyss or matzoon may also be serviceable then. Patients whose digestion is weak should take digestive powders after meals, and perhaps bitter tonics before meals.

**Harmful Effects of Drugs.**—During the stage of cardiac hypertrophy certain crude drugs may do harm; for example, iron and digitalis in massive doses should not be given, especially when there is high arterial tension.

Morphine has undoubtedly killed many a patient with contracting kidney. The indiscriminate practice of giving hypodermics of morphine and *repeating them* the same day can not be too strongly condemned in the treatment of this disease.

The patient with contracting kidney frequently has insomnia, and in routine practice a quarter of a grain of morphine sulphate is often given hypodermically. This may do no harm, but another one of increased dose, the same night, is dangerous, and in one case the writer knows of was apparently the cause of death, as the patient failed to awaken the next morning. We do not hear so much about these fatal cases as about those in which some therapeutic agent is reported to do

238 CHRONIC DIFFUSE NEPHRITIS WITH INDURATION.

good. Opium and morphine are known to have a cumulative action in contracting kidneys, and when needed should be given in single, not repeated, doses.

Herter calls attention to the fact that a single grain of methylene blue may precipitate uræmia when the latter is impending. Nitroglycerine and the nitrites in large doses are also said to be dangerous when acute uræmia threatens the patient.

Mercury in large doses should not be given in cases of contracting kidney of gouty or rheumatic origin, nor in those due to lead poisoning.

In chronic interstitial nephritis the writer has observed in several cases stomatitis follow the use of calomel as a purgative agent.

**Symptomatic Treatment.**—The usual remedies are Aconite, Arsenicum, Aurum muriaticum, Glonoin, Kali iodatum, Iodine, Lithium carb. or benz., Mercurius cor., Nitric acid, Nux vomica, Plumbum metallicum, Phosphoric acid.

The writer has seldom seen much *lasting* benefit from any of these, yet at times they appear to relieve certain symptoms, especially *Aurum muriaticum*, *Glonoin* and *Lithium benzoate*.

*Aconite*.—In the writer's experience 10-drop doses of the second decimal dilution of Aconite have been effective in controlling the feeling of "rush of blood to the head" which patients sometimes complain of in this disorder.

It may also be used in alternation with Glonoin when in connection with the above there is dizziness or vertigo.

*Aurum mur.*—Cardiac palpitation, pressing pain, or feeling of heat in the lumbar region extending to the bladder and down the sides; hyperæsthesia and over-sensitiveness to pain; general weakness, gastric and hepatic disturbances; patient hypochondriac and quarrelsome.

The leading indication for Aurum is the passage of much clear, pale, slightly albuminous urine *at night* so characteristic

of interstitial nephritis. The writer uses the Chloride of Gold and Sodium in doses of from  $\frac{1}{10}$ th to  $\frac{1}{5}$ th of a grain four times daily. A one per cent. solution of this substance in alcohol may be made, of which ten drops, four times daily, is the dose. It certainly relieves the nocturnal urination in some cases.

*Glonoin.*—This remedy is much used in conditions where there is high tension. In cases not urgent it should be given in doses of  $\frac{1}{15}$ th grain every two hours for long periods; alternation every third week with Caffeine, two grains every three hours, is sometimes desirable. For the acute blinding headaches it should be given in larger doses, but it has failed to relieve even in enormous doses. When apoplexy threatens, use instead *Sodium nitrite* in full doses, three grains every four or five hours, together with venesection and saline infusion as recommended by Dr. Carter.

The indications for Glonoin are polyuria, urine of low specific gravity, violent heart action, great arterial tension, heart's action easily excited, violent palpitation, throbbing carotids, pulsating headache, worse on stooping; purring noise in the heart when lying down, arrhythmic pulse, restlessness in the limbs, painless throbbing in all parts of the body, face bright red, puffy, cerebral hyperæmia. Its action is marked in arterial tension, uræmic headaches and asthma.

The therapeutic application of Glonoin and the Nitrites is also seen in angina pectoris, uræmic asthma and in the various high tension disturbances of primary chronic interstitial nephritis, as well as in arterio-sclerosis. *Amyl nitrite* acts more promptly than Glonoin, but its action is less prolonged.

*Erythrol tetranitrite* is said to produce effects lasting six hours without affecting the head unpleasantly.

*The Iodides.*—The indications for Iodine or Iodide of potassium are frequent desire to pass urine with profuse discharge, eructation, dry skin and cardiac hypertrophy. There are darting pains in the region of the kidneys, burning pains in

## 240 CHRONIC DIFFUSE NEPHRITIS WITH INDURATION.

the lumbar region, difficulty in walking ; the urine is clear and copious, especially at night, and of low specific gravity. (Compare Aurum muriaticum.) Use the first decimal except in syphilitic cases. The Iodide of sodium may also be given in the first decimal, or in one or two grain doses of the crude in water three or four times daily *after* meals.

In syphilitic cases give Merc. cor., second decimal, and Potassium iodide, 5 to 10 grains, in water after meals alternately three times daily. A convenient way to give the Iodide is to dissolve seventy-five grains in six and one-half ounces of water ; dose, one tablespoonful after each meal.

H. B. Millard, for routine treatment of chronic interstitial nephritis, placed the patient on full doses of Potassium iodide, and in addition gave Fowler's solution and Mercurius corrosivus.

Mercurial inunctions may be substituted for Merc. cor., and in obstinate cases the Protoiodide of mercury in one-quarter grain doses or more of the crude is often very serviceable.

The Iodide of strontium is frequently better suited to cases of interstitial nephritis with pronounced cardiac symptoms than the other iodides. Anæmic cases may require the iodide of iron.

If the patient is of bilious habit with coated tongue and sluggish liver the Protoiodide of mercury may be given for a few days.

The preparation known as Soluble Iodine and the Syrup of Hydriodic acid are also used instead of the various iodides.

*Mercurius corrosivus*.—This remedy in the third decimal trituration is used extensively in the routine treatment of contracting kidney, especially where there is retinitis. The writer can not report any very great success from use of it. Dr. Speirs Alexander records a well-marked case in which defective vision improved, power of accommodation returned, and retinal degeneration cleared up under use of this remedy.

*Mercurius dulcis* is said to be especially useful in intersti-

tial nephritis. In the writer's experience it should not be given too low when there is a tendency to uræmic stomatitis which it greatly aggravates.

*Nitric acid.*—Great weakness and prostration, especially in the morning with pressing pains in the lumbar region, nausea, excessive slimy secretions from mouth and throat, yellow coating all over the tongue with bitter or acid taste, bilious diarrhoea or constipation, haemorrhoids, anorexia, haematuria with urging after and shuddering along the spine during urination, skin dry, dark, dirty. Copious, pale urine of low specific gravity, and general symptoms of atonic gout. Use third decimal except as below when diuretic action is desired.

*Nitric acid* is sometimes useful in alternation with Glonoin for its stimulating action on the kidneys when arterial tension is at the same time relieved by Glonoin. A. L. Blesh recommends that it be given as follows:

B. Nitric acid, c. p., . . . . . ʒ iv.  
Aqua dist., . . . . . q. s. ad. ʒ ij.

Sig.—Thirty minimis in a full glass of water taken slowly after each meal.

*Nux vomica.*—Gastric disturbances in interstitial nephritis. Nausea, vomiting, polyuria in irritable, morose patients.

*Plumbum metallicum.*—Colicky pains proceeding from the spine, with obstinate constipation and retracted abdomen, marked tendency to uræmic convulsions, amaurosis from atrophy of the nerve, paralysis, slight dropsy, cutaneous anaesthesia, exceedingly pale skin, chlorosis, rapid emaciation, progressive debility, mental depression.

*Glycero-phosphates.*—In one or two cases the writer has used the Phospho-glycerate of Lime (Chapoteaut) in cases in which there was a ratio of urea to phosphoric acid above 13 to 1. In one case in which retinitis was a feature, apparent benefit was derived from use of the remedy. The patient, who had been unable to attend to his business on account of his eye trouble, recovered vision in a few weeks and went back to his

## 242 CHRONIC DIFFUSE NEPHRITIS WITH INDURATION.

office. In another case of the same character, now under treatment, slight improvement only has taken place.

*Potassium citrate*.—This remedy is fairly reliable, so far as its action goes, in cases where the urine is scanty and the patient drowsy and in danger of uræmia. The writer has unquestionably relieved several patients who were sinking into coma by administration of Potassium Citrate in doses of from 15 to 30 grains in water, four times daily. Free action of the kidneys is obtained and the patient rouses from his stupor.

### SPECIAL THERAPEUTIC MEASURES.

*Headache* is often obstinate, and may become a serious feature, lasting for years. For the acute, blinding cephalalgia Glonoin is sometimes efficacious, but has failed even in enormous doses. For the chronic headache, Caffeine in one case gave most relief, but was not curative. Caffeine in the form of the uncombined, chemically pure alkaloid is now used in doses of 5 to 10 grains; maximum dose, 10 grains at one time, 30 grains in a day. Caffeine combined with small doses of Strychnine is sometimes more efficacious than Caffeine alone. Searle mentions a case which *Baptisia* tincture relieved most.

Drop doses of the one per cent. solution of Nitroglycerin, every one to three hours, are quite commonly used when the headache or other symptoms of high arterial tension is severe.

*Dyspepsia* is often ameliorated by warm baths. Cold baths should not be used, as they increase blood-pressure.

For the *dysentery* rectal injections of solutions of Boracic Acid may be used.

*Nose-bleed*.—This is sometimes a serious feature. If the patient can have medical attendance *supra-renal extract* is of service. Some of the powder is to be mixed with a little water and applied in a swab by use of the nasal speculum and mirror to the point of haemorrhage. Solution of Adrenalin may be used instead of the extract. In case these substances are not at hand try the following :

Hydrastis internally in ten-drop doses of the tincture every two or three hours, and a spray of a 5 per cent. solution of the fluid extract in water. External compression upon the bleeding nostril, either by the fingers, iced cloths, ice-bags or ice; the hot nasal douche, water having a temperature of 90° F., injected until it emerges from the non-bleeding nostril unmixed with blood; ice in the mouth; cold cloths, ice or cold metals applied to the spine; immersing the scrotum in iced water; Chapman's bags, containing water at a temperature of 105° F., to the spine.

Internal compression: by means of absorbent cotton pledges which may be saturated with astringents in solution; by means of long, narrow strips of iodoform gauze, gently introduced until the nostril is entirely occluded; by means of small rubber bags, on the principles of Barnes' dilators. Finally, plugging the posterior nares with Bellocq's canula, which should be the *dernier ressort*, as it is not devoid of danger.

A twenty per cent. solution of Antipyrine, applied on cotton pledges, which are allowed to remain *in situ*, has been recommended as a reliable remedy.

**Uræmia.**—The treatment has already been discussed. Sudden cases, as when convulsions occur, with little or no warning, may require Pilocarpine hypodermically. When uræmia threatens, Belladonna, Glonoin, and especially Cannabis Indica in the lower potencies may be tried.

Alarming symptoms may be relieved by free catharsis. Mercurius dulcis in one-grain doses of the first decimal, five or six times, at night, followed by a saline in the morning, is advantageous for this purpose.

In cases where the patient is restless or wandering in his mind, has a heavy, foul breath and a coated tongue, salts should be given in the morning, and hot baths taken. Nitro-glycerine should be given the patient.

If he is comatose, active purgation and sweating by use of

**244 CHRONIC DIFFUSE NEPHRITIS WITH INDURATION.**

Pilocarpine or hot baths should be brought about. In case of convulsions Chloroform may be used, and twelve to twenty ounces of blood removed by venesection (Osler). To the above may be added also the use of normal salt solution before described. In cases where restlessness and delirium are marked Osler has seen no ill effects from the use of Morphine. The writer can endorse this with the proviso that repeated hypodermics on the same day be avoided.

**High Arterial Tension.**—When this is accompanied by symptoms of uræmia, the treatment is venesection, saline infusion and administration of nitrites. The combined treatment is especially valuable in averting threatening cerebral haemorrhage. Five to eight ounces of blood are to be withdrawn, followed by the infusion of about fifty fluidounces of hot normal saline solution, together with full doses of Sodium Nitrite, three grains every four or five hours, as suggested by Carter.

For milder cases Osler's suggestion is useful, namely, a light diet, occasional salines, sweating by means of hot air or other hot baths, and the cautious internal administration of Nitroglycerine, beginning with one drop of the one per cent. solution and gradually increasing to ten, three times daily, avoiding a dose which produces excessive flushing or headache, discontinuing after six or seven weeks' treatment, and then beginning again.

This treatment is usually sufficient for cases in which headache, dyspnoea and dizziness are a feature. The writer frequently alternates Aconite in ten-drop doses of the second decimal with small doses ( $\frac{1}{250}$ th grain) of Glonoin for a considerable period of time, weeks or months if necessary, until the dizzy spells cease for the time being.

Chloral hydrate is often efficacious in relieving the dilated arteries.

**Cardiac Hypertrophy.**—During this stage of the disease the smaller arteries are weak and liable to rupture, so that

there is danger from haemorrhages; hence keep patient as quiet as possible, restrict diet, and caution about running for trains, etc. Bowels to be carefully attended to in this stage; a hard, full pulse, fulness in the head and vertigo call for free, watery stools. Give Glonoin in dose as above, or the Nitrites of sodium or potassium in 3- to 5-grain doses every four or five hours, or Potassio-cobaltic nitrite in 4- to 7-grain doses. The nitrites are less likely to cause headache than the glonoin. If acute uræmia is impending, do not give glonoin or nitrites.

*For acute intercurrent attacks* at this time (shown by diminution in quantity of urine, increase in albumin and casts) do not give Digitalis in large doses nor use hot-air bath, as they increase tension, but keep patient quiet, on low diet, and promote free action of bowels, using Citrate of Potassium as a diuretic. If necessary, give Elaterium for the bowels.

It is not advisable to give glonoin or the nitrites in large doses continuously but only in emergencies.

**In the Stage of Cardiac Dilatation.**—Digitalis, Caffeine, Strychnine, and Iron are the remedies for prolonging life. Give 5-drop doses of fat-free tincture of Digitalis,  $\frac{1}{6}$ th grain doses of Strychnine sulphate or phosphate, or the Protochloride of Iron, according to the indications. Allow meat once a day.

If the urine decreases in quantity, give Apocynum. Hot-air baths may be tried when the patient is not too weak.

If dropsy increases, give Digitalis tincture in larger doses, say, 10 or 15 drops, with 5 or 10 drops of the fluid extract of Adonis, and that of Convallaria in 10- or 15-drop doses of the tincture, discontinuing for a few days if pulse becomes slow to a marked degree.

Inhalations of Amyl nitrite or administration of the nitrites are serviceable for the over-action of Digitalis and similar drugs. Salines may also be necessary, even when diarrhoea is present, in order to reduce the dropsy.

## 246 CHRONIC DIFFUSE NEPHRITIS WITH INDURATION.

For inflammations of the lungs Digitalis and 20- to 30-minim doses of fluid extract of Ergot.

Degenerative retinal lesions demand Iron and Strychnine; hemorrhagic ones leeching of the temples and 3 to 10 grains of Ammonium chloride in aqueous solution.

For the acute uremia of this stage (coma) give Jaborandi and Digitalis as before.

Obstinate diarrhoea may be modified by Veratrum album, Arsenite of copper, or Gallic acid.

The heroic treatment as described above will sometimes prolong life, but the outcome is always the same.

In one case in this stage hydragogin failed utterly to produce marked diuresis, although it increased the quantity of urine to a slight degree. In the writer's experience practically nothing has been of service. Aspiration of the chest for hydrothorax may produce temporary relief and saline transfusion may rally the patient when he is apparently moribund, but these measures merely delay the final outcome. The patient's heart and lungs are in such a condition that capsular nephrotomy cannot be performed on account of danger from the use of the anesthetic.

Stryphanthus must be used with caution in cases where there is advanced degeneration of the myocardium.

In this stage the patient suffers from restlessness and insomnia. In advanced and hopeless cases a single hypodermic of morphine at night is often a necessity. In other cases chloretone, paraldehyde, trional, sulphonal, or chloral-umale may be adequate to produce sufficient sleep. When Morphine is given, one-eighth of a grain plus one two-hundredth of Atropine is the proper hypodermic dose. Digitalis should not be administered continuously. It is best to reserve it for emergencies, or to give it in alternation with Glonoin or the Nitrites. Caffeine may prove serviceable. Strychnine can usually, however, be given with safety in large and repeated doses in any stage of the disease.

For the dyspnœa supra-renal extract in doses of three to five grains every six hours may be tried.

The patient will often be relieved from severe dyspnœa by the production of watery stools, for which purpose Epsom salt is serviceable.

**Surgical Treatment.**—If the operation of capsular nephrotomy is of value it should be tried in this disorder before the patient is in such a condition as not to be able to take an anæsthetic. The chances are, however, that he will be unwilling to be operated on in the earlier stages. Remissions of symptoms occur lasting for years sometimes ; during these remissions the patient seldom visits his physician, and would hardly be likely to realize the necessity for an operation.

#### ARTERIO-SCLEROTIC NEPHRITIS.

**Definition.**—A form of chronic diffuse nephritis with induration in which, as a rule, there is inflammation of the interstitial tissue, together with sclerosis of the blood-vessels of the kidney. In rare cases there is primary arterio-sclerosis without any noteworthy changes in the stroma.

The disease is, therefore, of vascular origin.

**Pathologic Anatomy.**—*The Kidneys.*—Normal in size or smaller, seldom larger ; hard and irregularly granular ; the color is cyanotic or reddish (beefy) in color.

**The Capsule.**—Strips easily, but is adherent in places.

**Section.**—Shows cortex reduced in size and of a dark-red color ; pyramids dark and congested, arteries like small, stiff tubes.

The surface of the kidney may show cystic cavities, and in some cases may be gray rather than red. The consistence of the kidney is not so tough as in primary chronic interstitial nephritis. The connective tissue hyperplasia is focal rather than general, and calcification is seen in the partly destroyed glomeruli.

**Pathologic Histology.**—The feature is an extreme thicken-

## 248 CHRONIC DIFFUSE NEPHRITIS WITH INDURATION.

ing of the blood-vessels, especially of the interna, not uniformly in all parts of the kidney, but generally focal in distribution. The pure form shows very little increase of the general fibrous tissue, but in the form combined with chronic interstitial nephritis it is not uncommon to find round-cell infiltration and connective-tissue proliferation in the inter-tubular stroma.

**Diagnosis.**—Osler says: “In persons over forty, with very high arterial tension, great thickening of the superficial vessels and marked cardiac changes, the renal condition is likely to be that of arterio-sclerosis, but for clinical purposes it is not necessary to differentiate from chronic interstitial nephritis.”

**Treatment.**—This should consider arterio-sclerosis in general. Diet and exercise are of prime importance. Articles rich in lime salts should be avoided, the quantity of food consumed not excessive nor the food fattening or indigestible. Milk, eggs, rice and spinach should be avoided as rich in lime salts. Patients between thirty-five and forty-five years of age must be especially careful not to take violent physical exercise.

Boch (*Zeitschrift f. Diaetet. und Physikal. Therapie*, 1898, II., No. 1; *Med. Rev. of Rev.*) declares that arterio-sclerosis is a true disease. It begins during the forties, and may even appear in the thirties. It is both more common and more dangerous than valvular disease, a fact not sufficiently appreciated. It is not amenable to remedies; while energetic purgation and venesection may temporarily relieve, diet alone holds out a prospect of cure. Diagnosis is not difficult; it is sufficient to find permanent increase of blood pressure with permanent augmentation of the heart's action.

Very different classes of people are predisposed to this disease. First may be named good livers who suffer from plethora. The very opposite class of half-fed and emaciated poor folk are also prone to become arterio-sclerotics; here the causes are purely psychical—worry, etc. Men who speculate,

brokers, bankers and those of similar occupations, are also predisposed, while a fourth class comprises men who do hard manual labor and at the same time use alcohol to excess. Scoliosis constitutes a special predisposition, due to the narrowing of the thorax, and consequent elevation of the blood pressure of the pulmonary circulation. Finally, arteriosclerosis is often inherited.

In general the diet should aim to cut down ptomaine- and leucomaine-producers on account of their deleterious action upon the vessels, and nucleo-albumins should be eliminated as far as possible. The following meats are permitted as being poor in nucleo-albumins: So-called white meats, including veal, chicken, lean pork and lamb. Beef may be allowed only when thoroughly cooked. These white meats may be replaced by liver, kidneys, etc.; the latter are poor in albuminoids, and tend to prevent the organ-albumin from decomposition. Of vegetables, only those are permitted which do not form much gas.

An arterio-sclerotic should never eat to repletion, because a distended stomach is a mechanical irritant to the heart; for the same reason all gas-producing food is to be excluded.

Alcohol, being a heart stimulant and vascular poison, should be avoided, with the exception of a little red wine or well-fermented beer; and even these are contra-indicated in advanced stages of the disease. Strong tea and coffee are forbidden.

**Remedies.**—These are chiefly palliative. The most important remedy is Iodine. Four grains of Iodide of Potassium in milk should be given twice a day until tolerance is established, when the dose is gradually increased to fifteen, three times daily. For a week out of each month it is omitted altogether, and after a number of months it is discontinued for a longer period than eight days. In this way it is given for at least a year and a half, or longer.

The lactates are useful also, especially where there is angina pectoris.

**250 CHRONIC DIFFUSE NEPHRITIS WITH INDURATION.**

Rumpf uses the following: Sodium carbonate, 10 grams; Lactic acid q. s., to saturate; to this add Lactic acid, 10 grams; simple syrup, 10 grams, and distilled water, 200 grams. Take the mixture once daily.

In the stage where resistance in the vessels has begun to overpower the heart, rest, with inhalation of oxygen and skillful massage, resistance gymnastics and Nauheim baths are useful measures, together with non-nitrogenous diet and remedies to lessen blood pressure.

Resistance gymnastics may be tried as follows:

The patient executes certain simple movements of flexion, extension and rotation of the extremities and trunk, and these movements are carefully resisted by the physician or trained attendant. The resistance offered must never be great enough to embarrass the patient's breathing or circulation. If these and other directions are properly followed, the effect on the heart is striking and beneficial. The pulse becomes slower, stronger and fuller, the heart's sounds grow louder and the area of cardiac dullness diminishes, as shown by the position of the apex beat and by percussion.

The remedies in this stage are chiefly Strophanthus, Strychnine, and Mercurius dulcis when needed.

In the last stage, that of cardiac dilatation, Babcock advises the following:

The sufferer should have rest and careful massage, with inhalations of oxygen. The diet must be light and simple, largely of milk, and all means must be considered that will allay or prevent flatulent distention of the abdominal viscera. Bowel movements should be kept free, so that the patient may not have to strain at stool.

Strophanthus or Digitalin is required, and whatever cardiac tonic is selected, it should be in conjunction with vaso-dilators, as the Iodides, Opium and the Nitrites. I consider Opium objectionable for several reasons, and generally prescribe one of the others. Nitroglycerine is the most frequently admin-

istered of all the nitrites. Erythrol tetranitrite is a new compound that is highly praised, because its effects are more lasting, about six hours, and it does not so often affect the head unpleasantly. Nitroglycerine is very efficient, but evanescent, and, therefore, it should be taken every two or three hours. One hundredth of a grain will dilate the arterioles powerfully without depressing the heart, and, therefore, this dose is sufficient as a rule. If cardiac asthma, nocturnal restlessness or insomnia occasion bad nights, a hypodermic of an eighth of Morphine with a two-hundredth of Atropine is excellent treatment. If cardiac dilatation and stasis become extreme, relief may be afforded by venesection, but is usually only temporary. When dropsy is extreme and does not yield to the usual diuretics, astonishing results are sometimes obtained by Diuretin; incision or puncture of the ankles may also be done. In this stage Babcock regards the Schott treatment as of but doubtful utility and often of actual harm.

Vigorous treatment may, and often does, bring some improvement for a time. It is generally transient, and upon each recurrence of the symptoms subsequent amelioration is more difficult. At length there comes a time when all treatment is unavailing, and it becomes the physician's plain duty to mitigate suffering and promote euthanasia. This should not be considered necessary, however, until after all means have been tried and proved useless.

Death usually comes through exhaustion, pulmonary œdema, or sudden arrest of the heart in diastole. Mild delirium may precede the end, or the senses be retained to the last.

## CHAPTER X.

### AMYLOID KIDNEY.

**Synonyms.**—Hyaline, waxy, lardaceous, or albuminoid degeneration, or infiltration of the kidney. Depurative infiltration of the kidney.

**Definition.**—All affections of the kidneys are included under this head, in which *the walls of the blood-vessels*, especially those of the glomeruli, are the seat of a degeneration with exudation which gives a chemical reaction resembling that of starch with certain reagents, as solution of iodo-potassium iodide plus dilute sulphuric acid; the dirty violet coloration given by starch with these reagents being noticed. It is called waxy, for the reason that the cut surface has this appearance.

**Forms.**—Three varieties of amyloid kidney are distinguished—*pure amyloid degeneration, the amyloid large white kidney, and the amyloid contracted kidney.*

The most frequent form is the second, and produces a marked enlargement of the kidney.

**Pathologic Anatomy.**—In typical cases we find the following :

*The Kidneys.*—Greatly enlarged, has a hard, tough, elastic feel; its color is pale, grayish-yellow, somewhat translucent like bacon.

*Capsule.*—Easily removed.

*Surface.*—Smooth, pale yellow, anaemic.

*Cut Surface.*—Waxy appearance, rather dry, but little blood.

*Cortex.*—Thickened, half the thickness of medulla, instead of the normal one-third or one-fourth. May be marked by reddish lines.

*Glomeruli*.—Quite dark and prominent; size of millet seeds, dull, semi-translucent.

*Medulla*.—Rays distinct, pyramids distinct and abnormally pale, less affected than the cortex.

NOTE.—If an aqueous solution of iodine (iodine in iodide of potassium) be added to the cut surface, the amyloid patches of the latter instantly turn a dark mahogany color; iodine and sulphuric acid give a violet appearance; methyl-violet, or gentian, a red, while normal tissues are stained pale blue.

The macroscopic features are *pallor of the kidney and translucency of the glomeruli*.

The vessels of the liver, spleen and intestines will often show similar degenerative changes.

*Microscopically* we find :

*Glomeruli*.—Rather enlarged; glassy in part only at first, later wholly.

*Bowman's Capsule*.—Lining at first unaffected; later, degenerated.

*Glomerular Capillaries*.—Walls affected by homogeneous, translucent thickening. At first, minute paraffine-like masses occur in them.

*Afferent Arteries*.—Walls affected by homogeneous translucent thickening.

*Interlobular Arteries*.—Walls affected by homogeneous translucent thickening.

*Basement Membrane of Convoluted Tubes*.—Affected later.

*Epithelium*.—Later becomes fatty, rarely amyloid.

The features are first a *homogeneous translucent thickening of the walls of the glomerular capillaries* and afferent arteries occurring irregularly in patches, some of which are limited; later involving the whole tuft of vessels in some places, the lining of Bowman's capsule, and even the basement membrane of the convoluted tubes with fatty degeneration of their epithelium.

If the tissues of the kidney are stained with methyl-violet,

or gentian-violet, the amyloid portion takes on a clearly defined and characteristic *red* color, and it is shown that the amyloid degeneration begins in the walls of the small vessels, that the stroma may be affected later while the renal epithelium itself remains free from it, although atrophic and fatty changes occur.

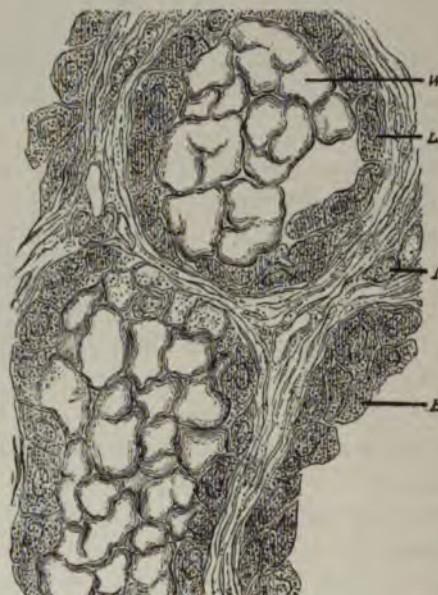


FIG. 16.—Waxy Degeneration of the Kidney in Chronic Croupous (non-indurative) Nephritis; Formation of a Waxy Cast. *W*, shining waxy lumps in the calibre of the tubule; *L*, epithelia and endothelia of the tubule, partly in waxy change; *E*, unchanged tubular epithelia; *I*, interstitial connective tissue. Magnified 600 diameters.—(From HEITZMANN.)

**Etiology.**—The disease is now said to be due to the long-continued action of the toxins of *staphylococcus pyogenes aureus*, the golden *staphylococcus*. Hence it is a disease secondary to *chronic suppurative processes*, such as occur especially in *tuberculosis*, *syphilis*, *osteomyelitis*, *cancer*, and most commonly that of pulmonary and intestinal tuberculosis associated with ulceration and cavity formation; necrosis of bone,

vertebral caries, old sinuses, long-discharging empyemas, chronic ulcerations of the skin or bowels, fistulas, psoas and lumbar abscesses, ulcerating cancer, especially uterine; pyonephrosis, purulent pyelo-cystitis, vesico-vaginal fistula and any obscure cachexia.

It may result from pulmonary tuberculosis not accompanied by suppurating cavities.

Bronchiectasis, localized suppurative peritonitis and actinomycosis may lead to the formation of amyloid material in the kidneys. The writer has seen two cases of sarcoma, one of the orbit, the other intestinal, in which the disease occurred in the last few months of life; also one case of general septicaemia with localized manifestations in the kidneys and pleura in which waxy casts, known to be absent from the urine previously, occurred in abundance during the last five days of life; these, however, might have been also referable to a suppurative peritonitis which was also present.

Syphilis, even before ulcerative or suppurative changes, is said to be a cause of it. It occurs sometimes late in the course of syphilis. Lead and mercury poisoning, gout, and malaria are given as causes.

Suppurative nephritis in one kidney is often seen in cases where both kidneys were involved in chronic diffuse nephritis with amyloid degeneration.

It is held by some writers that a syphilitic taint in connection with a suppurative process is absolutely essential for the production of the lesion.

The disease is usually associated with amyloid diseases of the spleen, liver, and intestine, but it may be limited to the kidneys.

Litten found tuberculosis of the lungs in 70 per cent. of cases of amyloid kidney; in 31 per cent. of these there were also tuberculous ulcers of the intestine. Rosenstein found out of 43 cases of amyloid kidney, 17 associated with ulcerative phthisis, and more than half of the latter were complicated with intestinal tuberculosis.

It is possible that the disease may arise without discoverable cause : primary toxæmia with resultant amyloid disease.

**Occurrence.**—The disease is most common between the age of 20 to 50, but it may occur at any age when dependent on surgical diseases.

**Development.**—It may take place even after a few months of a suppurative process.

**Diagnosis.**—There is no infallible symptom. Cases in which there is an enlarged liver and spleen, together with the voiding of clear urine, abundantly albuminous and containing a few large hyaline or waxy casts, are likely to be amyloid kidney.

**Clinical Features.**—In cases where the disease is not a complication of other renal lesions the cardinal features are *polyuria, albuminuria, and amyloid disease in other organs*. In addition we may find history of chronic suppuration or syphilis. The patient is anæmic, and in addition to pallor has muddy complexion, with brown rings about the eyes. Gastro-intestinal symptoms are common, especially vomiting and diarrhoea, together with dropsy and enlargement of the liver and spleen.

Uræmia, dyspnœa, retinitis, and cardiac hypertrophy are rare. Vomiting is sometimes noticed as above.

In some cases dropsy is absent altogether; in others is either moderate or severe. It is usually confined to the abdomen and lower extremities.

Secondary inflammations, as pneumonia, and also haemorrhages are rare.

In some few cases due to syphilis, bronchiectasis, and unilateral pulmonary contraction the general nutrition remains tolerably good for a considerable time and the patient lacks the pallid anæmic color to the skin.

The most prominent features are, first, the enlarged abnormally firm liver with hard sharp lower edge, the enlarged hard spleen, and the obstinate diarrhoea.

*The Urine* is more or less increased in quantity in the majority of cases, but sometimes is below normal, constantly contains much albumin, is clear, acid, of pale-yellow color and of specific gravity 1.010 to 1.015. The sediment is scanty and contains but few casts, which are mostly large, hyaline and waxy. Pus- and blood-corpuscles are not abundant.

The urine is often remarkably clear and may show no sediment to the naked eye. In addition to the large amount of albumin, 0.4 to 0.8 per cent. by weight, globulin may be present in relative abundance. In rare cases albumin is said to be absent.

A rapid and frequent variation in the amount of urine and percentage of albumin is said to be characteristic of this disease.

In well pronounced cases there may be as much as 3000 c. c. (100 fl. oz.) of urine in the twenty-four hours, with a specific gravity of from 1.003 to 1.012.

In cases where the large white kidney is also amyloid we find diminished urine of high specific gravity containing an enormous amount of albumin, up to three per cent. by weight, and in the sediment blood and pus corpuscles, fatty epithelia, and all sorts of casts including hyaline, granular, fatty and waxy.

In cases where granular kidney (primary chronic interstitial nephritis) is also amyloid we find a large amount of albumin in urine of low specific gravity. A few hyaline casts occur in the sediment. Cases in which secondary chronic interstitial nephritis is complicated by amyloid degeneration we find the same as above, except that the quantity of the urine is not likely to be increased.

**Duration.**—The disease may last anywhere from a few weeks or months to a year before death takes place.

**Differential Diagnosis.**—The disorder is to be differentiated principally from chronic diffuse nephritis without induration. History of a chronic suppurative process, associated amyloid

changes in the liver and spleen, and the clear urine with large amount of albumin, but very scanty sediment, serve to differentiate pure amyloid kidney from chronic diffuse nephritis without induration.

**Prognosis.**—The majority of the cases terminate fatally. It is said that some recover completely, but these are probably isolated cases. Fürbringer has never seen one recover.

In children where the disease is dependent on surgical affections the prognosis is more favorable; also in syphilis.

Exceptionally in such cases recovery may take place. Death takes place from progressive exhaustion or excessive œdema.

**Treatment.**—Prophylactic treatment is of especial importance, and depends upon skillful management or removal of the exciting cause. It should be the effort of the physician or surgeon to put an end to any suppurative process as soon as possible. It is said that cases are rarer now than in former times, owing to the improvement in the surgical treatment of the various etiological conditions.

**Diet.**—Purdy insists on a liberal and sustaining diet, the most nutritious compatible with the digestion, together with as much fresh air or moderate exercise as possible. Milk diet is not allowed, owing to the weakened condition of the patient. A good wine, as Burgundy, is highly beneficial at meals; wine of pepsin may be used with benefit.

**Symptomatic Treatment.**—The remedies commonly indicated are the Iodides (Arsenic, Potassium), Aurum muriaticum, Mercurius solubilis, Mercurius biniodatus, Hepar sulphur, Hydrastis, Nitric acid, Lycopodium, Phosphoric acid.

*Potassium iodide* should be given in syphilitic cases; indications already given under chronic interstitial nephritis; use first decimal.

*Arsenic iodide* given empirically by the writer in the second decimal when symptoms for Arsenicum occur in amyloid cases.

*Aurum mur.*—Indications given under chronic interstitial nephritis ; use third decimal or lower.

*Mercurius solubilis.*—For syphilitic cases use third decimal. *Mercurius biniodatus* in the same potency in cases where there are old buboes discharging for years, together with amyloid kidney.

*Hepar sulphur.*—In cases where abscesses are a feature use the third decimal.

*Hydrastis.*—Febrile disturbances, with gastric and hepatic disorders, in cachectic patients. Chills morning or evening, heat in flushes all over the body, followed by great debility. Use second decimal.

*Lycopodium.*—Carleton finds this remedy frequently indicated, inasmuch as the characteristic digestive symptoms are prominent, due to amyloid involvement of the mucous membrane of the stomach and intestines. There are sour eructations, frequent belching without relief, heart-burn, water-brash nausea after cold, but not after warm, drinks ; fullness and flatulency in the stomach and bowels ; gnawing, griping in the gastric region ; all symptoms are worse from 4 to 8 P. M.

*Phosphoric acid.*—Useful in cases of tuberculosis and other suppurative processes ; there is mental indifference, pain in the back, disturbances of nutrition ; use the first decimal.

**Palliative Treatment.**—In cases where the exciting cause can not be removed by surgical treatment, the following may be tried : In tuberculous cases, Creasote, Guaiacol, and the like ; in syphilitic cases, Mercurial inunctions and Iodide of Potassium ; in malarial cases, Arsenic, Iron, Quinine.

If there are lymphatic enlargements, Calcium chloride in five-grain doses, in milk, may be given.

If there is extreme weakness, dilute Phosphoric acid.

For digestive troubles, *Nux vomica*, Bismuth, Peptenzyme, Diastase, Pepsin, Caroid ; the wine of pepsin is said to be particularly good for these cases.

For excessive albuminuria Gallic acid in two-grain doses or more.

For the obstinate diarrhoea try Acetate of Lead in small doses of the crude drug, if nephritis be absent (shown by scantiness of sediment, few casts); rectal administration of deodorized tincture of Opium is sometimes successful. When intestinal ulceration exists, the diarrhoea is best controlled by Copper sulphate, one-tenth of a grain, and Belladonna tincture, with rectal administration of Opium. When dropsy and scanty urine are a feature, hot air-baths and diuretics will be needed.

Cathartics may cause obstinate diarrhoea in amyloid kidney, and in tuberculous cases Iron should not be given internally.

Eichhorst gives the Iodide of Iron in amyloid disease as follows: Equal parts of syrup of the Iodide of Iron and simple syrup. Dose, a dessertspoonful three times daily.

#### INFILTRATIONS OF THE KIDNEY—DEGENERATIONS OF THE KIDNEY.

**Calcareous Infiltration.**—This may occur in chronic interstitial nephritis in cases where there is atrophy of bone with absorption, as in old persons, in poisoning by certain substances as Corrosive sublimate, Phosphorus, Bismuth, Aloin, etc., and in cases of pyelitis where the urine is decomposed in the pelvis; Calcium oxalate may be deposited in the kidneys in conditions favoring its formation, either of diet or metabolism.

The deposits are whitish or grayish-white, and may be found in the pyramids or on the surface.

**Urate Infiltration.**—Deposits of urates occur in gout and in the uric acid diathesis. They may appear as yellowish-white lines in the pyramids, but chiefly occur in the cortex.

*Uric acid infarcts* are an almost constant feature in the urine of the new-born. As a rule they disappear promptly, otherwise they lead to irritation, and by blocking the tubules may cause uræmic phenomena.

**Argyronia** or deposits of silver may occur following the

ingestion of large quantities of silver salts, especially the nitrate. The deposit is found chiefly in the cortex, and in rare cases has been known to be due to local applications of a salt of silver to the mucous membrane.

**Glycogenic Infiltration** occurs in diabetes mellitus, and involves especially the epithelium of the loop of Heale.

Necrosis of the convoluted tubules is often present in association, especially in cases dying suddenly of diabetic comā.

**Dropsical Infiltration** (hydropic change or oedema) is common in acute inflammation; it affects both epithelium and stroma.

**Leukemic Infiltration** is often found in leukemia of the kidney affecting the stroma, with an enormous accumulation of leucocytes. The kidney is much enlarged and mottled, with grayish-yellow areas; uric acid infarcts may occur at the same time.

**Bilious Pigmentation** occurs in jaundice. In the icterus of the new-born the so-called *bilirubin infarct* occurs.

**Hemoglobin Pigmentation** is found in cases of poisoning by agents such as Hydrogen Arsenide, Carbolic Acid, Potassium Chlorate, etc.; also in infectious diseases, especially malaria, extensive burns, exposure to cold (*paroxysmal hemoglobulinuria*), etc.

The kidneys are enlarged and of a brownish-red color.

**Amyloid Degeneration** is the result of suppurative diseases. (See Amyloid Kidney.)

**Hyaline Degeneration** is probably closely allied to the above and may precede it; both are often associated in the same kidney. It is frequently found in chronic interstitial nephritis and affects the glomeruli chiefly. Calcareous infiltration may occur in the hyaline areas.

**Cloudy Swelling** occurs in the course of infectious diseases and in poisoning by Arsenic, Corrosive Sublimate, Phosphorus and the mineral acids; mercurial treatment for syphilis may cause it. It is one of the most frequent processes in the kidney

and affects the epithelial cells, particularly those of the convoluted tubules. It results in enlargement of the kidney. The surface has a peculiar opaque appearance, so that the organ looks as if it had been cooked. The process has a marked tendency to pass into fatty change, but may undergo retrogression, in which case the kidney assumes a more or less normal appearance. The clinical features are increased frequency of urination and diminished urine containing albumin, blood and casts. There is no oedema and no arterial tension. The treatment in cases of poisoning is to eliminate the poison and to administer the proper antidote. In the course of infectious diseases the usual remedies for the primary disease should be administered, or other remedies called for by urinary symptoms, among which Apis, Belladonna, Terebinth are most frequently indicated.

**Fatty Change.**—This accompanies severe inflammation and is especially common in the large white kidney. It may also be due to anaemia, to the toxins of infectious diseases, acute yellow atrophy of the liver, and certain poisons as Arsenic, Chloroform, Phosphorus, etc. The convoluted tubules are most affected. The treatment is that of the cause.

#### CHRONIC DEGENERATION.

**Etiology.**—Due to cachexia as of tuberculosis or cancer; most commonly to circulatory obstruction from cardiac or pulmonary diseases; may arise without known cause. The disease may follow passive hyperæmia.

**Morbid Pathology.**—The kidneys may be normal in size or enlarged and heavier than normal. The surface is smooth and the markings distinct. Congestion of the pyramids is a marked feature. There is a swollen, granular condition of the epithelia lining the uriniferous tubules, and the condition is one of chronic degeneration of these cells.

**Clinical Features.**—The history is usually one of passive hyperæmia, and the symptoms progressive weakness and

emaciation with death from asthenia. The urine may be normal or contain a small amount of albumin and a few casts. The treatment consists in nutritious diet, attention to the general health and administration of remedies symptomatically, as Arsenicum, China, Phosphorus, Phosphoric acid, Rhus tox.

## SYPHILIS OF THE KIDNEY.

Syphilis of the kidney occurs in the form of gumma but rarely. When found, gummas are in the cortex or in the pyramids, rarely in both at the same time. They vary in size from that of a pinhead to a hazelnut. As many as twenty to sixty may be found. There may be suppuration or a diffuse gummatous infiltration in which the kidney becomes enlarged even to such an extent as to weigh seventeen ounces even as early as two months after infection. Symptoms suggesting acute or subacute nephritis may occur due to syphilis.

In acute cases the disease may appear in two to three months after the chancre is seen. The kidney resembles that of acute post-scarlatinal nephritis. The clinical features are diminished urine, frequent micturition and the abnormal constituents of scarlatinal nephritis. Cœdema, headache and digestive disturbances occur. The prognosis is favorable. The dietetic and hygienic treatment is the same as in acute nephritis. The principal remedy is Mercurius cor. or sol. in the third decimal.

*Chronic cases* are found in later stages of syphilis. The kidney may be either contracted, amyloid, or gummatous. The symptoms are those of chronic nephritis in general. When the gummata break down, the urine contains a large amount of débris, is of dirty-brown color, and contains albumin, blood and epithelial casts. The treatment is anti-syphilitic, with milk or mixed diet, regular hours and hygiene (Carleton).

**Leprosy.**—Lepromatous lesions are rare, but various non-specific inflammations of the kidney are not rare in leprosy.

**Glanders.**--In human glanders the kidney is seldom affected.

**Actinomycosis.**--In this disease the kidney may be secondarily involved. In one instance a case of what appeared to be primary renal actinomycosis was observed.

**Leukemia.**--Lymphomatous nodules are found in the kidneys in typhoid fever and sometimes in other infectious diseases.

#### TRAUMA.

**Synonym.**--Injury to the kidney.

**Etiology.**--Commonly due to puncture, gun-shot wounds, or external violence.

**Clinical Features.**--As a rule but one kidney is injured. The symptoms are immediate shock and collapse, pain in the region of the kidney, local haemorrhage and haematuria. Rupture of the kidney manifests itself by a swelling and rise in temperature, not usually above 105° F. Anæmia may occur.

**Treatment.**--This consists in rest, hot applications and stupes. Internally the remedies are Aconite, Arnica, Belladonna, Chamomilla and Veratrum viride.

Nephrectomy may be necessary in cases of peritoneal involvement, otherwise drainage and packing of the wound with iodoform gauze. In rupture of the pelvis the edges should be sutured when possible, and in cases of dislocation of the kidney suture to the abdominal wall is advised by Carleton.

#### FISTULÆ.

These are seldom of surgical origin, but more commonly due to traumatism or rupture of abscess, presence of foreign body, excessive, long-continuing suppuration, incomplete drainage, etc.

Fistulæ are either renal-intestinal, opening into the colon and attended by vomiting and purging of pus and urine; renal-gastric, which are very rare, but may occur in cases of calculus; renal-bronchial and external renal fistula. The last named are usually quite direct and open in the lumbar or inguinal region.

An erythematous patch of integument surrounds the ulcerated opening, from which pus and urine escape. The treatment is free direct drainage, whenever possible. The ureter should be either rendered previous or, if this cannot be done, nephrectomy is indicated if the other kidney is normal (Carleton).

## CHAPTER XI.

### SUPPURATIVE NEPHRITIS.

**Synonyms.**—Acute interstitial nephritis with suppuration. Abscess of the kidney. Pyelo-nephritis. Surgical kidney. Purulent nephritis.

**Classification.**—We distinguish two classes according as infection reaches the kidneys; first, hæmatogenic, embolic or metastatic suppurative nephritis, and, second, urogenic suppurative nephritis.

**Etiology.**—Bacteria are the direct exciting cause. They may reach the kidneys through the blood or lymphatics on the one hand, or by way of the urinary passages on the other. Hence we distinguish the two forms, *hæmatogenic* and *urogenetic* purulent nephritis.

#### HÆMATOGENIC SUPPURATIVE NEPHRITIS.

In this disease we find the infection due to conveyance of bacteria by the blood-stream, hence it is found in general pyæmic conditions, in ulcerative endocarditis, in osteo-myelitis, diphtheria, scarlet fever, dysentery, small-pox, puerperal infection, bed-sores, pulmonary tuberculosis, and actinomycosis. The sequence may be, in some cases, first, the infectious process; second, ulcerative endocarditis, local abscesses, or suppurative thrombo-phlebitis, or arteritis, and, third, suppurative nephritis.

Infectious or septic emboli containing bacteria, as from infectious endocarditis, infectious thrombus of the lungs, or some vein, being transferred to the kidneys, cause abscess there. *Hence malignant endocarditis*, resulting from a number of diseases, may be the cause of it.

In general it may be an accompaniment of infectious processes localized elsewhere in the body. The micro-organisms capable of producing it are primarily the common pyogenic cocci, then the pneumococcus, and, in rare instances, the typhoid bacillus and the actinomycetes.

**Pathologic Anatomy.**—We find *yellowish-white nodules*, variable in size and number, in the kidneys, which are visible through the capsule and represent small abscesses. There may be only a few or the whole kidney may be riddled with them.

The size of the abscess varies from that of a pin-head to a hazel-nut, or, in rare instances, even larger. They are surrounded by a red areola, sometimes by distinct haemorrhages. The kidneys are, as a rule, both affected, are enlarged and sometimes quite soft. The cortex is usually wider than normal and both it and the medulla show yellowish areas of suppuration. Microscopically the abscesses show themselves as dense collections of polymorphonuclear leucocytes, which invade the interstitial tissue and fill the lumen of the tubules and the capsular space of the glomeruli. It is often possible to find bacterial emboli as the cause of the abscesses. Degeneration of the renal tissue within the confines of the suppurative process always occurs.

As pyæmic abscesses seldom communicate with the uriniferous tubules, there may be no great amount of pus found in the urine.

#### UROGENIC SUPPURATIVE NEPHRITIS.

This is the disorder commonly known as *surgical kidney*, an ascending infection of the kidney produced by suppurative processes anywhere in the urinary tract.

**Etiology.**—Cystitis, especially that due to vesical calculus, is the most common cause, producing pyelitis by infection, which in turn produces suppurative nephritis. Less commonly pyelitis, due to stone or tumor, is a cause. Ureteritis

from compression by tumors may also be a cause; the ureters are seldom much altered by infection ascending from the bladder. Gonorrhœa and stricture are also causes.

**Pathologic Anatomy.**—*The kidney* may show either one abscess or a great number; in the latter case they may be either discrete or confluent. The size varies from that of a pin-head to one large enough to fill the whole space between renal capsule and renal pelvis.

When the abscess results from extension of the inflammation from below, we find opaque, grayish, *bead-like streaks along the pyramids from apices to renal cortex*, having an injected border, and tending, as they enlarge, *to become confluent, soft in the center, and to form an abscess*.

Usually one kidney only is affected, especially when primary pyelitis is a cause, but even when due to cystitis both kidneys are not necessarily affected. The kidney is enlarged, hyperæmic and soft; in advanced cases the papillæ melt away, and in extreme examples the organ is converted into a large pus sac, to which condition the term *pyonephrosis* is applied.

The principle organism responsible for the infection is the *Bacillus coli communis* (acid urine), next the *Proteus vulgaris* (ammoniacal urine).

Microscopically we find that *the collecting tubules* may contain in earlier stages *colonies of bacteria, often of the Bacillus coli*; the epithelium is necrotic; the adjacent interstitial tissue infiltrated with leucocytes. The epithelium of the convoluted tubules undergoes granular degeneration. In long-standing cases the abscesses may be surrounded by a more or less well-defined connective tissue wall.

**Results of the Abscess.**—Previous presence of renal abscess is shown by a scar, which is depressed, or by a calcified nodule. If the suppuration extend to the paranephric fat tissue, we have paranephric abscess. This, or the renal abscess, may communicate with the pelvis of the kidney, or with the gastro-intestinal tract.

The abscess may rupture into the liver, pleura, bronchi, the peritoneum, or even externally, forming a renal fistula. In some cases the pus becomes encapsulated or absorbed, the acute process terminating in a chronic fibroid change in the kidney. Amyloid disease may result.

**Diagnosis.**—This may be difficult, especially in the haemogenous form. In the cases of pyelo-nephritis the history of previous urinary disease, the onset of septic symptoms, and the presence in the urine of micrococcus casts, together with pus, albumin, and possibly blood, are the most characteristic features.

It is difficult to draw a sharp line in ascending cases between pyelitis and pyelo-nephritis, since the one usually merges into the other.

**Clinical Features.**—In cases due to endocarditis the symptoms may not be perceived. In cases due to trauma or surgical interference there is a violent and repeated chill, fever, sweat, vomiting and other digestive disturbances, together with pain and swelling in the region of the kidneys. In ascending cases the features may be divided into three groups, as follows :

1. Those of general sepsis.
2. The local alterations in the kidney.
3. The changes in the urine.

The symptoms of general sepsis are as follows :

1. Irregular chills, with corresponding elevations of temperature.
2. Continued intervening fever, with not so high temperatures as during the chills; sometimes remittent fever.
3. Various nervous, digestive, circulatory and respiratory symptoms, as in fevers ; the symptoms may simulate uræmia.
4. The patient has generally *an anxious expression*; face at first flushed, later sallow or jaundiced ; *mouth dry* ; *tongue coated* (often brown), fissured, crusted ; pulse rapid, feeble ; there may be pallor, thirst, loss of appetite, headache, vomit-

ing, hiccough, diarrhoea, profuse sweats, drowsiness, sopor, and low *delirium*.

The local symptoms in the kidney are as follows :

Pain which is either spontaneous or provoked by pressure ; the pain is seldom severe unless there has been an injury to the kidney or an involvement of the peritoneum.

The kidney is usually palpable, and at times there is fluctuation ; in some cases the distention of the kidney by pus is such that a tender tumor may be readily perceived in the loin.

**The Urine.**—In *metastatic abscess* we may be unable to find marked evidences of the disease in the urine.

In *pyelo-nephritis* we find alkaline, offensive urine, with more albumin than the pus accounts for, and swarms of micro-organisms.

Even though the urine is alkaline, tube-casts composed of pus, but more commonly of micrococci, may be found in small numbers with a little care. In the writer's experience they are of the utmost value in confirming the diagnosis. Occasionally, in severe cases, a day or two before death they may be numerous and easily found.

In some cases we do not find more albumin than the pus accounts for.

There is not uncommonly blood in the urine due to perforation of the blood-vessels by the destruction of tissue.

Rarely there are found fragments of desquamated renal tissue—renal sequestra—which may be as large as a pigeon's egg, and which microscopically show the features of renal tissue.

In some cases there is polyuria and urine of low specific gravity. Not rarely we observe vesical tenesmus and pain on urinating.

In children pyelo-nephritis manifests the following features :

1. The presence of severe gastro-dyspeptic symptoms, such

as anorexia and vomiting, with pain in the region of the kidneys, and the long continuance of these symptoms.

2. Constipation. There may be shedding of large pieces of membrane, mingled with hardened faecal masses.

3. The variability of the urine, changing from a perfectly healthy specimen to one containing large quantities of albumin, pus, morphotic elements and mucus.

4. The peculiar type of fever, intermittent in character, with chills and general malaise, which may be accompanied by a gradual but constant emaciation.

5. The urine in cases of pyelo-nephritis shows, according to Baginsky, the presence of the bacterium coli in pure culture.

**Course.**—The course of the disease may be either acute, subacute, or chronic. In old cases of urinary disease, purulent nephritis sometimes runs a rapid course; the writer has seen several patients who lived but a week or two after the first severe chill. In other cases the patient may survive several months or longer.

**Complications.**—Pulmonary oedema, erysipelas, dropsy, paranephric abscess.

There may be renal colic from passage of pus through the ureters, and acute hydronephrosis from obstruction of the latter. If the obstruction is not relieved, uræmia and urinary septicæmia may ensue; in some cases paralysis of the lower extremities—urinary paraplegia—may be observed.

Rupture into the abdominal cavity is speedily followed by a rapidly fatal peritonitis.

**Differential Diagnosis.**—Injury, or signs of a malignant endocarditis, together with the clinical features and urine as above, distinguish the abscess sometimes called metastatic. History of disease of the lower urinary tract or surgical operation on the same point to the surgical kidney.

Suppurative nephritis is distinguished from pyelitis by the graver constitutional symptoms, viz.: Irregular high temperature, delirium and chills, with a tender tumor in the loin.

The intermittent presence of pus in the urine is more likely to be due to suppurative nephritis, while a continuous but remittent flow of pus in an acid urine suggests tuberculous, calculous, or obstructive pyelitis.

**Prognosis.**—Depends on whether the pus is absorbed or discharged into the urinary or gastro-intestinal tract; in the latter case, prognosis is serious. When one kidney only is involved, patient may live some little time. When both kidneys are affected, prognosis is serious. Prognosis is also usually serious in patients who have had prolonged obstruction to escape of urine from a stricture or enlarged prostate. Recovery is, however, possible in these cases, but permanent renal atrophy results. In pregnancy the prognosis is favorable, the case being a removable pressure.

In a few cases spontaneous cure is effected by the inspissation of the pus forming masses resembling putty, in which a deposit of lime salts may take place.

In cases due to trauma or surgical interference, recovery may take place or the patient pass into a typhoid condition and die.

In cases due to enlarged prostate death is the rule, as is the case usually when the disease is of bacterial origin.

**Cause of Death.**—Death is usually preceded by profound coma. Convulsions are rare. In cases where there is rupture into the abdomen, peritonitis is the cause of death. Death usually takes place, however, from progressive exhaustion or urinary sepsis.

**Prophylaxis.**—If the patient has a chronic disease of the lower urinary tract, all instruments used must be thoroughly sterilized. Enforced retention not allowed; patient to be supplied with rubber urinals. Avoidance of cold and damp to be enjoined, sitting on cold or wet objects to be prohibited.

The urine may be efficiently sterilized in many cases by use of Urotropin in doses of seven and one-half grains (0.5 gm.), two to four times daily in plenty of water.

**Diet in Renal Abscess.**—The patient being put to bed the following diet is advised: Soups, milk, yolks of eggs free from white and beaten up with brandy; arrowroot flavored with Madeira, broth from veal stock thickened with cream and arrowroot, boiled sago or tapioca with a little milk. Stimulants to be given freely if there is much asthenia. If urine scanty, give large quantities of diluents, barley water, linseed tea, warm water, but no saline diuretics.

Liquid peptonoids, Somatose, beef peptonoids, malted milk, clam broth, matzoon, and fresh buttermilk may be given.

**Treatment.**—Apply antiphlogistine to the region of the kidneys, and give one tablet of protonuclein every two or three hours. Dry cupping may be tried for relief of congestion and to favor diuresis. Dampen the bottom of an ordinary tumbler, drop in a piece of loose, dry cotton, moisten the skin with warm water, light the cotton, invert the glass instantly, and, if the cotton sticks to the bottom of it, apply to the region of the kidneys.

If a cupping-glass with rubber bulb be at hand, the above process may be dispensed with.

Open the bowels once daily with warm enemata or mild purgatives.

Hot fomentations and hot baths, if possible, are of service.

**Remedies.**—As palliatives the remedies are the urinary disinfectants, as Salol, Urotropin, Boric acid, Eucalyptus and the Benzoates.

In one case, apparently due to pyelitis, a mixture of corn-silk, broom-tops and lithia, known as lithiated sorghum compound, in teaspoonful doses, apparently hastened recovery.

Elaterium may be needed if there is obstinate constipation with scanty urine, or Ergot, if with polyuria.

If foul urine accumulates in the bladder, there is probably less risk in drawing it off than in letting it stay; after catheterization an antiseptic solution may be introduced.

The writer has had considerable experience with the solu-

tion of Boracic acid suggested by Ralfe, namely, *pure* Boracic acid, 120 grains; Glycerin, one fluidounce; hot water, eight fluidounces. A few teaspoonfuls daily will usually suffice to keep the urine acid and prevent decomposition. In some cases, however, even this agent fails.

It should be tried, however, in cases in which Urotropin fails, as it sometimes does, to render the urine clear and acid in nature.

**Symptomatic Treatment.**—The usual remedies are Aconite, Arnica, Belladonna, in the beginning; Hepar sulphur, Silicea, and Veratrum viride later. These remedies should not be forgotten when, for any reason, surgical treatment is impossible. Hekla lava and Sodium sulphocarbolate are also suggested by Carleton.

**Surgical Treatment.**—In unilateral cases nephrotomy is the treatment when the diseased organ still contains considerable healthy tissue, otherwise nephrectomy is necessary. The capsules of one or both kidneys may be incised in order to relieve tension.

#### PARANEPHRIC ABSCESS.

**Synonyms.**—Suppurative paranephritis, perinephric abscess.

**Definition.**—Purulent inflammation of the *fat* capsule of the kidney. The terms perinephric abscess and perinephritis are used synonymously with paranephritis, but should be confined, strictly speaking, to inflammation of the *fibrous* capsule, and not to that of the fibro-fatty tissue in which the kidney is embedded.

**Etiology.**—Due to extension of inflammatory process from elsewhere, or from a wound, surgical operation, or various suppurative lesions. Occurs in the sequence of infectious diseases, especially typhus, typhoid, and small-pox.

Most commonly found in *suppurative nephritis*, *chronic renal tuberculosis*, or by extension from *appendicitis*, *spinal*

*caries* and *empyema*. It is found in association with lumbar and psoas abscesses, suppuration of the retro-peritoneal glands, traumatic infections, perforation of the intestine and pyæmia. *Perinephritis* may, in addition, be produced by operations on the kidney.

Paranephric abscess may result from purulent absorption in cases of inflammation of the connective tissue about the uterus, vagina, or rectum after childbirth, and is not an uncommon complication of pelvic cellulitis.

It may follow surgical operations on the testicle or spermatic cord after inflammation of connective tissue about the bladder; or operations on the rectum, perinæum, or uterus.

Suppurations in the gall-bladder, liver and spleen may be followed by it.

In a few cases it seems to result from invasion by the *Bacillus coli communis* without traumatism, especially in middle-aged men apparently in perfect health. It may be due to cancer or *echinococcus* of the kidney, to carcinoma and tuberculosis of the vertebræ, to duodenitis, psoitis and purulent pleuritis. Paratyphlitis and ulcers in the colon may be a cause. In some cases renal embolism has been known to cause it.

**Occurrence.**—Twice as often in men as in women. More frequent in adults than in young people.

**Diagnosis.**—A painful swelling in the loin with fever suggests paranephric abscess. (See also Differential Diagnosis.)

**Onset.**—In some cases the disease may have an insidious onset and merely complicate other diseases, with a prolonged course and very moderate constitutional symptoms. If appendicitis is the cause, the onset is sudden and the progress rapid.

**Clinical Features.**—Following some one of the etiological conditions above mentioned is noticed a chill, fresh rise of temperature, sweating and deep-seated lumbar pains radiating into the thigh and testicle, with later a painful swelling in the loin.

The fever is a common feature ; it is often intermittent and associated with chills and thirst ; the temperature is persistently elevated, however, in many cases. There are disturbances of digestion, constipation, debility and emaciation. The respirations may be quickened, the swelling may extend upward and crowd the diaphragm, causing dyspnoea.

There may be severe shooting pains in the leg, numbness and paresis.

As a result of the fever and pain the patient may become thin and feeble to an extreme degree.

The patient has a constrained attitude and bends forward toward the diseased side. When in bed he lies on the diseased side, holding the vertebral column convex toward the healthy side, with the lower extremity of the diseased side flexed at the hip and knee-joint (Eichhorst).

The feature above described, namely, bending of the trunk toward the affected side, is said to be a valuable diagnostic sign.

If the collection of pus lies anteriorly, the patient is more likely to lie with the thigh flexed and to complain of pain radiating into and about the hip-joint and the testicle.

**Localized Symptoms.**—1. Swelling occupying lumbar region ; space between lower ribs and crest of ilium sometimes bulges. If not, the swelling may be perceived by bimanual examination, with patient in dorsal position.

2. Pain in region of the kidneys, worse on pressure ; sometimes extends into the legs, worse on movement.

3. Skin in region of the kidneys congested and oedematous.

4. Marked mobility of the kidney.

In general a painful tumor in the region of the kidneys, together with fever, points to paranephric abscess.

**The Urine.**—1. Features of renal congestion ; trace of albumin ; a few blood corpuscles.

2. If pus is present with pelvic epithelia, pyelitis co-exists.

3. Sudden large quantity of pus shows rupture of abscess into the urinary tract. Fat in abundance may be present.

4. Unless the abscess results from trauma or pre-existing urinary disease, urine may be normal, except when abscess is so large as to cause renal congestion.
5. Aspiration may reveal presence of pus, when urinary examination is negative.



FIG. 17.—Perinephritis.—(MORRIS.)

**Differential Diagnosis.**—It is to be distinguished chiefly from suppurative nephritis. In paranephric abscess we find a large tumor, so that the space between the lower ribs and crest of the ilium sometimes bulges. In suppurative nephritis there may be merely a well-defined lumbar swelling extending downward. The urine, in cases not due to trauma or previous urinary disease, is normal, that of suppurative nephritis never normal. For other features in the differential diagnosis see table of diagnosis of tumors.

Abscess in connection with spinal caries may suggest paranephric abscess, and may even open into the pelvis of the kidney. Molecular fragments of carious bones may be found in the pus and assist the diagnosis.

Moreover in spinal and hip-joint disease we find the characteristic deformities and limitation of motion.

From renal calculus it is distinguished by the presence of constitutional disturbance and by physical examination; from appendicitis by the history and the location of the pain and swelling; from abscess of the gall-bladder in a similar way; from psoas abscess by the fact that in psoas abscess the pus tends to point in the groin, and the swelling and pain are anterior to the anterior axillary line; from lumbago by the fever, tenderness, swelling and lateral inclination.

**Course.**—The course may be either acute (four to six weeks), subacute (several months) or chronic (longer than four months).

**Effects.**—May extend both upward and downward and perforate the loin, perineum or groin, the urinary tract, vagina, intestinal tract, or the peritoneum or pleura.

Pleurisy is a common complication; it is usually serious and on the same side.

The duodenum is sometimes perforated by the abscess.

Paranephric abscess is a large one, hence the liability of neighboring organs to be perforated by it.

If the pus is absorbed or encapsulated, a chronic fibroid inflammation usually takes place and involves the kidney-capsule and para-renal tissue. The kidney is then ensheathed in a thick mass of cartilaginous hardness, to which it is usually adherent. Total necrosis of the kidney may follow thrombosis of the renal artery, due to contraction of the para-renal tissue.

**Prognosis.**—Depends on that of the cause.

*Favorable* if cause can be remedied, when disorder primary and recent, provided early surgical treatment is resorted to, with drainage.

*Unfavorable* if pus is allowed to burrow, since abscess may rupture into peritonæum, pleura or intestines.

*Unfavorable* when secondary to grave renal lesions, or those of neighboring organs.

*Unfavorable* when secondary to spinal disease.

*Most unfavorable* when the disease follows the puerperal state in septic conditions, or violent infection in long-standing kidney troubles.

Recovery possible in cases where patient has strong constitution, even after bursting into bowels.

Recovery follows both absorption of pus and spontaneous evacuation, when cause of disease is remediable.

Recovery from spontaneous evacuation presupposes free drainage and freedom from sepsis.

Death may take place from septicæmia, embolic abscesses, progressive emaciation, exhaustion, or lardaceous degeneration of the kidneys (amyloid kidney); or the patient may sink into a typhoid condition.

**Treatment.**—Absolute rest, milk diet, free movements of the bowels, cold applications (ice bags) when as yet no redness or fluctuation. Cupping and application of leeches may relieve the pain and congestion. Inunctions of Belladonna or application of a liniment of Chloral and Camphor, equal parts, for the pain; Morphine by mouth or rectum may be necessary.

As soon as pyrexia and rigors suggest suppuration, aspirate and apply large hot poultices.

If fluctuation can be made out, and there is increase in the symptoms, an incision is advised with drainage.

## CHAPTER XII.

### CYSTS AND TUMORS.

We have to distinguish between simple cysts and cystic degeneration. In the writer's opinion this distinction is not usually made sufficiently clear in the books. Cysts may be found in kidneys otherwise healthy, in which case there may be only one cyst or several, and the usual size is not larger than an apricot, though cases occur in which they are of size sufficient to make an abdominal tumor. Cysts are found in diseased kidneys, in which case they are multiple and sometimes innumerable, and in greater or less numbers are a constant accompaniment of chronic interstitial nephritis. There may be combined cystic disease involving the liver and spleen as well as the kidneys.

When now the cysts occur in diseased kidneys in such numbers and of such size as to exceed all other changes in the kidney, and to produce extreme enlargement of the organ, forming an abdominal tumor, the term *multilocular cystic kidney* or *polycystic kidney* is used.

#### MULTILOCULAR CYSTIC KIDNEY (POLYCYSTIC KIDNEY).

**Definition.**—Enlargement of the kidney due to formation of innumerable cysts in one, or usually both, kidneys, producing symptoms resembling those of renal atrophy.

**Etiology.**—All cysts probably arise from dilatation of the tubules or of Bowman's capsule, caused by obstruction to escape of urine. Congenitally, absence of ureter or other malformation interfering with escape of urine may cause the disease, and in adult life chronic interstitial nephritis, by distal

constriction of uriniferous tubes, may cause proximate dilatation of them by the urine, but in addition there is usually symmetrical enlargement of both kidneys in the cases occurring in adult life.



FIG. 18.—Cystic degeneration of the kidney. - (MORRIS.)

**Occurrence.**—The large majority of cases in adults are congenital, though possibly in some cases it may be an acquired disease. It may occur in several members of the same family; the writer has seen it in a brother and sister. Most of the congenital cases die ante-partum or shortly after delivery, which accounts for the rarity of the condition among adults.

In many cases the condition is not discovered until post-mortem. The condition is often associated with other malformation, as hare-lip, club-foot, absence of renal pelvis and ureters, or absence of the duct of Botal.

**Pathologic Anatomy.**—The shape of the kidney is in the main retained, the size enlarged from that of a fist in congenital cases to that of an infant's head in adult cases, and the weight increased, reaching from 2 to 16 pounds. Both kidneys, as a rule, are uniformly enlarged, spongy, and lobulated from presence of innumerable cysts of all sizes, the larger ones the size of plums and usually in the centre of the organ, separated from one another by an intervening grayish-white fibrous structure. The cysts occupy both medulla and cortex. Renal tubules and glomeruli are here and there recognizable in the fibrous structures. The cysts are essentially closed cavities.

**Contents of Cysts.**—The cysts contain fluid varying in consistence and in color. A thin, watery fluid is common, but viscid, syrupy, caseous or almost solid contents may be found. Urinary salts and albumin are found in the thin liquid, as well as blood-pigment. The more solid contents consist of fat-granules, epithelium, cholesterol, uric acid and triple phosphate. It is said that urea is not found in the cyst fluid.

**Symptoms.**--In the foetus the abdomen may be so distended as to interfere with childbirth or prevent the descent of the diaphragm, causing death from asphyxia or paralysis of the heart. The longer the person lives the larger the diseased kidney, the number of cysts increasing with the growth of the person. In adults the symptoms are those of chronic interstitial nephritis (enlargement of left ventricle, increased tension, pallor, cachexia) plus haematuria, obstinate in character, and usually a bilateral, soft, non-fluctuant renal tumor, with sense of tension and pain in the loin. In later stages nausea, vomiting, headache and suppression of urine are ob-

served. The patient dies of coma, or more frequently of convulsions; less frequently of exhaustion following renal haemorrhage, bronchitis, pneumonia, or pulmonary oedema, with severe dyspnoea.

The disease may remain latent and be discovered only at autopsy, or it may remain latent for a long period and then suddenly lead to fatal uræmia.

In a case which the writer saw, in a man about 40 years old, there had been for three years no symptoms other than the urine of chronic interstitial nephritis and the presence of an enormous tumor in each lumbar region, of the shape of the kidney, containing nodulations and protuberances easily made out. Six months before death slight haematuria appeared, the urine diminished in quantity while albumin, leukocytes and epithelial debris increased. He began to complain of abdominal distention and weight, and of headache, vertigo and visual disturbances. Haematuria and uræmic symptoms became more marked.

A few days before death the urine contained so much albumin that it became a solid mass in the Esbach tube on addition to the urine of the picric acid solution. The patient died of coma, which lasted several hours. At the post-mortem, which the writer attended, the kidneys were found to be enormously enlarged. The right kidney weighed six pounds and the left five and one-half pounds, several hours after removal from the body. There was perfect, complete and absolute metamorphosis of the kidneys into a congeries of cysts.

The complete analysis of the urine in this case was published by the writer in the *Philadelphia Medical Journal*. Aceto-soluble albumin was found in the urine.

The clinical history and results of post-mortem examination have been narrated by Dr. I. N. Danforth in *American Medicine*, July 5, 1902.

**Effects.**—The tumor may cause displacement upward of the liver, spleen, diaphragm and lungs, and death may take

place from suffocation or paralysis of the heart. The tumor may rupture and cause perforating peritonitis.

**Differential Diagnosis.—**

CHRONIC INTERSTITIAL, NEPHRITIS.	CANCER.	CYSTIC DISEASE.
No tumor.	Tumor.	Tumor.
Hæmaturia, not common or obstinate.	Hæmaturia.	Hæmaturia, obstinate.
No pain.	Pain.	No pain.
No cachexia.	Cachexia.	Cachexia.
Patient over 40.	Patient under 5 or over 60.	Patient 40 to 55.

The tumor in cancer is rapid in growth, nodular, and of unequal resistance; in cystic disease, bilateral, of slow growth, non-fluctuant and soft, preserving the shape of the kidney, while the aspirating needle withdraws fluid.

**Prognosis.—**In the new-born child, if appreciable enlargement is found, early death may be predicted.

In the adult prognosis is unfavorable, but patient may live for years after discovery of tumor.

**Dangers.—**Suppression of urine, coma, and especially convulsions; exhaustion from obstinate hæmaturia; pulmonary lesions.

**Treatment.—**The medical and hygienic treatment is that of chronic interstitial nephritis. Absolute rest and administration of styptics, when there is hæmaturia. The latter may resist all treatment.

It is possible that in some cases puncture of the cysts or nephrectomy may be performed, if the other kidney is healthy. According to Osler death took place in a case in which one kidney was removed.

**HYDATID CYSTS.**

**Formation.—**Due to encapsulation and proliferation of the parasite *tænia echinococcus*.

**Etiology.—**The disease may occur at any age, but most

commonly between twenty and fifty. It is slightly more common in men than in women.

The use of uncooked meats and salads in places where dogs live in close association with their masters is sometimes a feature in the history.

**Position.**—The cysts are usually unilateral, on the left side, and unilocular.

**Diagnosis.**—A tumor in the loin, with vesicles, scolices or hooklets in the urine, points to echinococcus.

**Clinical Features.**—The tumor is likely to be large, filling the whole side of the abdomen. It may show by quick, short, bimanual percussion-strokes, a peculiar whiz known as hydatid vibration. Passage of the daughter-cyst through the ureter may occasion renal colic. If the cyst rupture into the kidney, hooklets may be found in the urine. Aspiration should reveal the same (Fig. 19 (b.) ).

After the passage of the vesicles through the ureter there is further trouble expelling them through the urethra. Retention of urine takes place, with excessively frequent desire to pass water and severe pain extending to the head of the penis. Expulsion of the vesicle requires considerable force and may take place with a loud sound followed by passage of urine looking like soap-suds.

**Differential Diagnosis.**—Hydatid cysts are to be distinguished from cystic kidney, abscess of the kidney and hydro-nephrosis. If there are no scolices or hooklets in the urine, exploratory puncture may reveal them. The tumor may suppurate and resemble abscess of the kidney. The renal colic may be mistaken for that of calculus.

**Effects.**—Pressure on other organs may produce asphyxia, palpitation and cardiac pain.

**Prognosis.**—Uncertain, usually unfavorable.

**Treatment.**—Surgical. Occasional cures are claimed.

When the cyst has ruptured, and the vesicles are being freely discharged from the bladder, there remains little for us

to do but to watch the progress of the case. The abdomen should be firmly bandaged, and gentle friction employed over the tumor to aid their escape. The patient should be warned against undue exertion or engaging himself in any occupation likely to cause strain during their discharge for fear suppurative action be excited, or even rupture of the discharging cyst

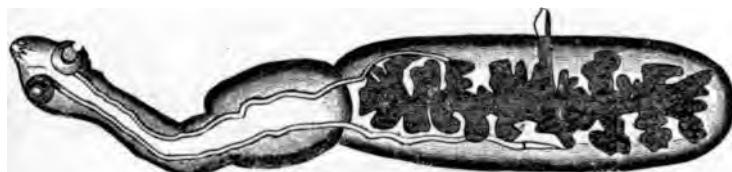


FIG. 19 (a).—*Taenia Echinococcus* complete.  $\times$  about 16.—(PORTER.)

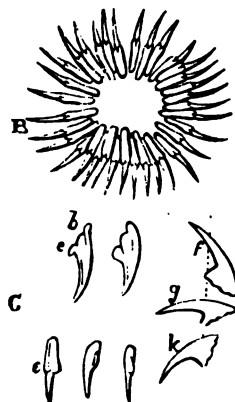


FIG. 19 (b).—(B.) The circle of hooklets seen upon its under surface; thirty-four in number, seventeen long and seventeen short. (C) b, c, Lateral views of the separate hooklets—b, the base; c, the central extremity or bifid process of the base; e, hooklets viewed upon the concave or inferior border; f, g, k, a diagram illustrating the movements and position of the hooklets.—(RALFE.)

caused. As diuretics have been found to assist the discharge of the vesicles, these remedies may be administered, and if there is much pain from colic during their passage, sedatives should be combined with them.

In other cases nephrotomy or nephrectomy is to be performed. The possibility of cure from injection of Mercuric

chloride solution (1:1000) into the tumor has been considered.

**Dermoid Cysts.**—These may occur in the kidney, but they are very rare. In cases where small reddish hairs are found in the urine the possibility of such a tumor occurring must be considered.

#### TUMORS OF THE KIDNEY.

We distinguish two varieties, benign and malignant.

Benign tumors are fibroma, lipoma, myoma and adenoma. Some writers mention myxoma, angioma, lymphoma, chondroma, osteoma, cavernous tumors and gummata.

Malignant tumors are sarcoma and carcinoma.

#### BENIGN TUMORS.

**Lipoma.**—These are among the rarest of tumors. They are sharply circumscribed, somewhat wedge-shaped neo-formations, situated, for the most part, in the cortex. They do not grow much above the size of a hazel-nut. (D. J. Hamilton.)

Warthin observed a lipoma which weighed two pounds and microscopically presented the features of a fibrolipoma.

**Fibroma.**—According to Hamilton, this is a round growth about the size of a mustard-seed or larger, gray in color, and much resembling a tubercle. It will often be found lying in the medulla. It is usually a single tumor, and is composed of fibrous tissue arranged more or less concentrically.

They may be mistaken for tubercles, but are harder, more glistening and more circumscribed.

In rare cases they attain a very large size; Wilkes observed one that weighed over 37 pounds. The kidney sometimes consists of a conglomerate mass of fibromas of considerable size. Fibromas tend to become cystic. Cholesterin is often present in the cyst-fluid, and calcification of the solid portions of the tumor is not rare.

**Myoma.**—The kidney is comparatively often, according to

Hamilton, the seat of a tumor usually described as striated myoma. It is always congenital, and, although small at the time of birth, gains bulk rapidly, so that at death it may distend the abdomen and weigh several pounds. It is located at first around the kidney, and subsequently envelops and destroys it. Some cavities filled with thick, brown-colored liquid may alone indicate the former locality of the organ. It is firm in consistence at parts, soft at others, and sometimes throughout its substance little barley-seed-like masses of hyaline cartilage may be detected. The whole aspect of the tumor is that of a sarcoma, but there are microscopical differences, some of the cells showing a distinct cross striation.

*Rhabdomyoma* usually grows in connection with the kidney, sometimes with the testis, and is always congenital.

*Liomyoma*, composed of unstriped muscle-tissue, occurs with extreme rarity in the kidney in association with fibroma.

*Osteoma* and *Chondroma* have been found in the kidney, but are extremely rare.

*Pure myxomas* are very rare, but myxomatous degeneration of other connective tissue tumors is common and gives rise to the belief that the tumor is really a myxoma. (Riesman.)

*Cavernous angiomas*, such as are found in the liver, are also met with in the kidney. They are bright-red masses, from the size of a cherry to that of a walnut, and are usually situated beneath the capsule, sometimes in the pelvis, constituting a cause of haematuria.

**Adenoma.**—Adenoma is sometimes a multiple growth; the tumors reach the size of a pea or hazel-nut, or even larger. They project from the surface and are mostly sub-capsular. If large, they push the kidney aside and are sharply demarcated from it. Sutton holds that the only tumor of the kidney to which the term renal adenoma is applicable is what is known as congenital cystic kidney.

Shattock maintains that remnants from the meso-nephros (Wolffian body) and the meta-nephros (true kidney) often serve as matrices.

*Lymphadenomas* have often been found growing in the kidney.

Adenomas are generally small, whitish and multiple, and occupy the cortex; they may attain a large size and become cystic. By excessive proliferation and bursting of the basement membrane adenomas may be transformed into carcinomas.

Adenoma may proceed from displaced portions of the suprarenal capsule.

Benign tumors are, as a rule, rarely of practical importance, owing to insufficient size and number.

In some cases, the kidney being absorbed from disease, its place is taken by true adipose tissue. In a case operated on by Dr. Charles Adams, complete replacement by fat took place in connection with a large retroperitoneal tumor (lipomyo-fibroma).

Villous papillomas grow occasionally in the kidneys.

**Clinical Features.**—In benign growths there may be no features recognizable, until the tumor has attained such a size as to cause discomfort by reason of its weight and the pressure exerted on surrounding organs, and it is rarely that non-malignant growths attain so large a size.

#### MALIGNANT TUMORS.

These are sarcoma and carcinoma. They occur both as primary and secondary tumors, and are distinguishable from each other only by microscopical examination.

**Sarcoma.**—This is the most common malignant renal tumor. Primary ones are occasionally seen in the adult kidneys. They are usually of the round-cell type, and may grow to a great size. Sutton distinguishes three species, as follows:

1. Spindle-celled sarcoma and its variety, myosarcoma.
2. Round-celled sarcoma.
3. Tumors composed of adenoid tissue.

In a very large proportion of cases they are congenital or are noticed within a few months of birth.

The growth of sarcoma is rapid, and the tumor usually reaches an enormous size before it destroys life. The mass is smooth, and pseudo-fluctuation is usually present. The tumor is composed usually of round cells. The malignancy of sarcoma of the kidney is very great, and recurrence after extirpation of the kidney is the rule. (Senn.)

The occurrence of sarcoma in the kidney is of great importance in the general theory of tumors, since it points definitely to development of new growth from scattered portions of embryonic tissue. The striped muscular fibres found in them cannot possibly come from the kidney.

As to the *etiology* of sarcoma we find the following :

It has a very striking tendency to occur in childhood rather than in adult life. It has been found in still-born infants. The female sex is more frequently affected than the male. The left kidney is more often affected than the right ; sometimes it is bilateral.

Trauma is important in the etiology ; it occasionally develops in floating kidney.

Peculiar *mixed tumors* occur in the case of children, but are very rare, though not unknown, in adults. In addition to the ordinary sarcomatous elements, glandular tissue, non-striped and striped muscle-cells and sometimes cartilage are found. For a time they grow slowly and then, especially after trauma, they take on rapid growth, attaining in a few months the size of a child's head. Metastasis takes place late and even in absence of it cachexia develops.

The left side is more likely to be affected, but the disease may be bilateral. The average weight is eight pounds, but as high as thirty-six pounds has been observed. Microscopically, *tubular structures* are striking features of these tumors, resembling the collecting tubules of the kidney ; a stroma made up of round or spindle-cells also occurs.

The urine, as a rule, in these cases is free from albumin or blood, and operative removal is of doubtful value.

A peculiar and anomalous tumor is met with in rare cases lying in or around the kidney substance, to which it is difficult to assign a name. It grows to the bulk of a walnut or orange, is rounded, sharply cut off from the kidney-tissue, and provided with a capsule. A striking feature on section is the diversity of color of the exposed surface, suggesting a sarcoma in some parts, but in others there are cyst-like cavities filled with deep-brown-colored thick fluid, evidently the remains of an old haemorrhage. (Hamilton.)

**Carcinoma.**—There is undoubtedly a primary cancer of the kidney which springs from the epithelium. The tumor may grow to such an extent as to occupy the whole of one side of the abdomen. It is extremely hard and tough, and nothing may remain of the affected kidney but a number of cysts filled with a thick brownish-red fluid. Most cases described as carcinoma are really sarcoma.

Carcinoma of the kidney is of the tubular variety, and the columnar epithelia are arranged in the form of tubules in a delicate, very vascular stroma.

According to the degree of development of the stroma the tumor is either hard or soft, of slow or of rapid growth. In exceptional cases the tumor, instead of springing from a matrix of embryonic cells representing kidney-tissue, originates from a displaced matrix of epithelia derived from the supra-renal capsule.

True carcinoma, developing from the adult epithelial cells of the kidney, is rare, but secondary cancer may occur in the kidney as in other organs; chorio-epithelioma (deciduoma malignum) not rarely gives metastasis to the kidney.

Primary carcinoma is usually unilateral and occurs as a diffuse infiltration. Secondary carcinoma is more likely to be bilateral and occurs as circumscribed nodules.

The growth may be either dense and fibrous, soft and med-

ullary, or consist of cavities containing colloid material, hence the terms fibrous, medullary and colloid cancer.

#### MALIGNANT DISEASE IN GENERAL.

**Etiology.**—Primary malignant disease is more common in males than in females, and in early or late adult life. Occasionally it is found at birth.

Secondary malignant disease takes its origin from malignant disease in the vicinity, and especially from primary malignant disease of the testicles.

It is said that malignant renal disease is frequent in the case of girls in whom there is an abnormally early growth of hair on the pubes and in the axilla, and who exhibit peculiar pigmentation of the skin.

It is common in children under four years of age.

It has been found several times combined with cancer of the testicle.

Renal calculi seem to cause development of carcinoma.

**Pathologic Anatomy in Carcinoma.**—The disease may affect one or both kidneys. In secondary malignant disease the right kidney is more often affected. The disease occurs as diffuse infiltration or as nodules, the latter being more frequent in secondary cancer.

**Character of the Tumor (Carcinoma).**—The affected kidney is, as a rule, increased in size, but its shape is usually maintained. The surface of the tumor is usually lobulated. The mass varies in consistency, throughout or in different portions, from scirrhouous to soft medullary or encephaloid. The color varies according to conditions present, as fatty degeneration, necrosis, hemorrhage or pigment formation, hence may be gray, whitish-yellow, red or black.

The tumor may in some cases be enormous in size, as large as a man's head, producing appreciable distention of the abdomen and displacement of the abdominal viscera, and may weigh as much as twenty pounds.

**Location.**—The fibrous capsule of the kidney may overlie the tumor or may have been perforated by it, or the capsule may separate the tumor from the kidney.

The neoplasm may grow into the renal vein, and from there into the inferior vena cava. It frequently projects into the renal pelvis, dilating and completely filling it.



FIG. 20.—Cancer of the kidney.—(RAYER.)

**Diagnosis.**—The essential features in the diagnosis of malignant growths of the kidneys are as follows:

1. The position of the tumor.
2. Its limited mobility.

3. The relations to the colon.
4. The age of the patient (child or old person).
5. The occurrence of an unaccountable hæmaturia in an old person.

**Clinical Features of Malignant Growths in General.**—These are the following :

1. Pain and pressure.
2. Progressive emaciation and cachexia.
3. Hæmaturia.
4. Swelling.

*The pains* are either fixed or else shoot outward and downward from extension of the growth to the lower dorsal and lumbar nerves ; usually a dull ache or paroxysmal pain, and not affected by movement. When there is pressure on lumbar nerves, there may be extreme pain in the chest, lumbar region, back, hip, testicles, thigh and leg.

The patient may complain of a dull, aching, lumbar pain, sometimes radiating along the course and distribution of the genito-crural nerve. In some cases there is scarcely any pain for a long period of time.

*Pressure* on the sciatic nerve may cause sciatica and paresis ; pressure on the diaphragm, lungs and heart may cause dyspnoea, palpitation and a sense of constriction about the chest.

*The pressure*, if on abdominal veins, may cause oedema of lower extremities or ascites ; if on abdominal viscera, then vomiting, anorexia, icterus and irregular bowel movements.

*Cachexia* is especially significant, when the patient has not lost much blood and still has fairly good appetite. Cachexia is sometimes but little noticeable in sarcoma.

*Hæmaturia* may be an early symptom. It may be constant or intermittent, slight, or sufficiently severe to prove rapidly fatal. Renal colic may be noticed from passage of clots of blood (worm-like) which may be found in the urine. In elderly persons hæmaturia often precedes recognition of tumor.

The blood is frequently voided as clots, which often show as moulds of the ureter or even of the pelvis of the kidney, or the blood may be entirely fluid.

The bleeding may be frequent, rare, or entirely absent. There is renal colic only when large clots are passed.

It is unusual to find small particles or shreds in the urine ; the writer thinks, however, that they might be found more often if precaution were taken to dissolve the blood in water by dilution with several times its volume.

*The Tumor.*—When large enough to be palpable, is found to be a deep-seated mass in the lumbar region, which may be movable, lobulated, and across which inflation of the colon will show the latter to pass. The tumor does not move with respiration. In some cases fluctuation may be noticed.

Persistent violent pain in the region of the kidney, which cannot otherwise be accounted for, with progressive cachexia, warrants the gravest suspicion of malignant disease, even though other features are absent.

Persistent haematuria (whose renal origin may be suspected by the dark color, absence of clots, etc.), with cachexia, suggests renal cancer, even if pain is absent and no enlargement can be detected.

Guillet declares that an important symptom of malignant disease is the presence of a suddenly-occurring and rapidly-growing varicocele.

Considerable difficulty and pain on micturition are noted in early stages of malignant disease, even when the bladder is not affected.

*Various Symptoms.*—A constant and marked increase in the pulse-beat has been noticed ; eventually there is marasmus, but general symptoms may be late in appearing.

The patient walks with the body bent forward and is afraid to rotate or flex the vertebræ.

*The Urine in Cancer.*—In addition to the blood, epithelia and fragments of the tumor may be found. Connective tis-

sue in large amounts may be a feature. (See writer's *Urinary Analysis*, 3d Ed., Chapter XLIX.)

Glycogenic generation in the epithelia is of diagnostic importance, according to Quincke.

The urine in sarcoma has been described in the writer's book on *Urinary Analysis*, page 322. Heitzmann demonstrated the sarcoma corpuscles, midway in size between the blood-corpuscle and the pus-corpuscle. (See also page 322 in *Urinary Analysis*, by the writer.)

In carcinoma the occurrence in the urine of numerous epithelial cells, and especially cell groups with multiple nuclei, is a suspicious sign.

**Differential Diagnosis.**—Bimanual palpation may show the following in cases of cancer of the kidney:

1. Tumor in the lumbar region of the shape of the kidney.
2. Location behind the colon (determined by inflating the latter).
3. Tumor not movable.
5. Tumor separated by the intestine from liver and spleen (shown by resonance on percussion, unless intestine is pushed aside).
6. If the tumor is soft and lobulated, aspiration may remove a liquid containing urea and cancer fragments.

The tumor must be differentiated from enlarged spleen, tumors of the liver, distended gall-bladder, pelvic tumors, as of the ovaries; large psoas abscess, tumors of the retro-peritoneal glands.

Enlarged spleen may be felt as a moving body with characteristic edge; it moves with respiration.

Tumors of the liver and a distended gall-bladder are easily movable, and are not overlaid by the distended colon; they are also more superficially placed and jaundice is a prominent symptom.

Pelvic tumors proceed from below and are not covered by the intestine. Their movement is lateral and downward.

## DIFFERENTIAL DIAGNOSIS IN RENAL TUMORS.

HYDRONEPHROSIS.	CANCER.	CYSTIC DISEASE.	PYONEPHROSIS.	PARANEPHRIC ABSCESS.
Tumor, unilateral or bi-lateral.	Unilateral.	Unilateral or bilateral.	Unilateral or bilateral.	Unilateral, rarely bilateral.
Fluctuant as a rule, sometimes hard.	Non-fluctuant.	Non-fluctuant.	Fluctuant.	Fluctuant in time.
Irregular form.	Irregular form.	Shape of kidney.	Irregular form.	Irregular form.
Varies in size from time to time.	No variation in size.	No variation; <i>Hydroid Cysts</i> : diminution in size of tumor after renal colic.	Varies in size.	No variation in size.
Painless or feeling of weight and dragging.	Severe and almost constant pain.	Usually painless until suppuration.	Considerable pain in lumbar region, worse on pressure in front, relieved by pressure behind.	Severe lancinating and increasing pain.
Hæmaturia rare.	Frequently-recurring hæmaturia.	Hæmaturia moderate until late.	hæmaturia after exercise.	When very large blood and blood casts in urine.
Fluid pushes forward. Aspirated fluid, neutral or feebly acid, never alkaline.	Fluid accumulations push forward.	Fluids push forward. In Fluids push forward. Aspirated fluid never acid, some times neutral, usually alkaline.	Fluid accumulation pushes backward.	
Intermittent discharge of urine, watery urine.	Urine not intermittent.	Urine not intermittent.	Intermittent discharge of Urine not intermittent.	
But little constitutional disturbance. No oedema.	Eventually well-marked cachexia. Loss of flesh, Anæmia. Ascites and oedema lower extremities when pressure on abdominal veins.	Sallow complexion, hypertrophy of heart, arterial tension as in interstitial nephritis. Sometimes dropsy.	May be signs of uremic poisoning, but usually absence of marked fever.	Great constitutional disturbances; continuous elevation of temperature. Marked rigors and sweat.

Neoplasms of the retro-peritoneal glands are more centrally placed and quite immovable. In some cases the differentiation is impossible.

The diagnosis is important in the case of the left kidney. In general we find the descending colon pushed forward by the tumor and lying between it and the abdominal wall. Almost all larger tumors of the kidney displace the diaphragm up but the neighboring organs laterally. By making a gentle thrust in the renal region it is sometimes possible to feel the tumor strike the abdominal wall (renal ballottement).

**Effects.**—Not rarely it may cause displacement of the liver, stomach, spleen and intestines. There may be rupture of the kidney, with external fistula or peritonitis as a result. Hypostatic œdema may follow rupture into the blood-vessels. Neuralgia or paralysis of one lower extremity may result from pressure on adjacent nerves. Spinal pressure paralysis may result from penetration of the vertebral canal through the intervertebral foramina.

**Prognosis.**—In unilateral sarcomatous disease extirpation of the affected kidney has relieved symptoms and prolonged life. When both kidneys are affected, death is usual in a year or two after recognition.

In children the disease is fatal in from ten weeks to a year. In adults from five months to seven years; on an average in two and a half years.

As a rule the disease lasts but a few months, rarely over two years. Death from carcinomatous marasmus not uncommonly takes place in a year.

**Causes of Death.**—These are as follows:

1. Prolonged cachexia.
2. Gangrene in the tumor, resulting from fistulæ between growth and intestine or surface of body.
3. Hæmorrhage from rupture of vessels near the surface of the tumor, either into the urinary tract or peritoneal cavity.

**Operative Treatment.**—In carcinoma excision is justifiable

only in very rare cases, where the diagnosis is made unusually early.

Even in sarcomatous cases duration of life beyond three years is unusual.

Primary nephrectomy is indicated in cases of malignant growth. The mortality in eight years has been extraordinarily diminished, as a rule—from 61.22 to 24.40 per cent. Those who remain free from recurrence for two years may be regarded as cured, though recurrence has been known after three years. The only hope is, therefore, in early nephrectomy.

**General Treatment.**—The tumor may be prevented from dragging by use of a flannel roller.

Constipation is to be overcome by appropriate means.

Clots and coagula are to be removed by gently washing out the bladder.

The pain is to be quieted by application of liniments containing Aconite or Belladonna, or by a mixture of Chloral hydrate and Camphor.

As a rule, Morphine must be administered when pain is severe.

Hæmaturia, if profuse, requires complete rest, cold applications to the abdomen, administration of Hamamelis, Ergot, Ipecac, Millefolium, Thlaspi in 30-drop doses of the tincture, Gallic acid in 2 to 10-grain doses, or solution Adrenalin chloride 1:1000 in normal salt, 5 to 30 minims internally; also suprarenal liquid with Chloretone (0.8 per cent. Chloretone), 5 to 30 minims, with syrup or wine.

In general the treatment consists in sustaining the patient with a nutritious diet, and in administering narcotics and styptics. Arsenicum is often indicated symptomatically and may relieve some of the distressing Hypernephroma symptoms.

#### HYPERNEPHROMA.

Grawitz has shown the astonishing frequency with which

portions of the supra-renal tissue are found under the true renal capsule. This aberrant adrenal tissue may give rise either to simple hyperplastic or to malignant neoplasms, which correspond in structure to the adrenal cortex, especially the zona fasciculata, but with less regular trabeculæ. The tumors are extremely vascular and haemorrhages into them are common. They are distinctly encapsulated and may cause metastasis into the lungs, liver, bone, etc. If malignant, the primary focus may be very small and the metastasis enormous in proportion. Their growth as a rule is slow and, unless transmission along the veins has occurred, they give rise to but few clinical symptoms. Owing to their vascular character all that may be found will in some cases be merely a large cyst containing blood.

**Etiology.**—They occur in persons thirty-seven to sixty years of age, more frequently in men than in women.

**Pathologic Anatomy.**—They vary in size, but rarely they are very large, reniform, and compress or destroy the greater part of the kidney substance. On section they are whitish or yellowish. Glycogen is found in them and also lecithin.

In the case of a tumor of this nature removed by L. L. McArthur, of Chicago, the following were the findings:

Extirpated kidney, size of a cocoanut.

The anterior surface shows only toward the hilum and upper and lower poles a resemblance to the normal external appearance of a kidney. The remainder is occupied by an irregular, nodular tumor, a portion of which is broken down and the capsule torn off. The nodules extend as much as one-half inch above the niveau of the external surface; on section they are yellowish in color and are continuous with the main tumor mass to be described.

On the posterior surface the appearance resembles more nearly the external appearance of the kidney, the lower portion yellowish, the upper mottled red and yellow. There are only two such nodules visible as are described on the anterior

surface, which are present along the convexity. One of these projects three-quarters of an inch beyond the niveau, about the size of a walnut, and on section it seems to be continuous with the main tumor-mass. The other is about the size of a bean; on section it is seen to be distinctly encapsulated; it contains one small cyst and some yellowish pigmented masses, and is distinctly separated from the surrounding cortical tissue of the upper pole at which both are situated. About the middle of the posterior surface is a cyst in the cortex projecting slightly above the niveau. It was ruptured during the operation and looks like a simple retention-cyst. Section of the kidney in median line shows that a tumor more or less circular in form occupies the center of the kidney. The dimensions of the sections are  $7\frac{1}{2} \times 9$  inches. The tumor is distinctly encapsulated; toward the posterior surface it has caused an atrophy of the renal tissue to such an extent that that which remains varies in width from a mere connective-tissue capsule over the middle of the convexity, about one-sixteenth of an inch in thickness, to one-fourth of an inch at the hilum.

In the anterior half there is no trace of kidney-tissue over the tumor.

At the upper and lower poles, there remain portions of renal tissue; in these the relation of cortex to medulla appears normal, is extremely firm, with well-marked glomeruli.

The tumor itself is distinctly encapsulated, easily separated from upper and lower poles of renal tissue, shows toward the periphery, in what are apparently recent areas, a yellowish, more or less homogeneous structure, the nodules varying in size from a pea to a walnut, each separated from the other by septa, which arise from the tumor capsule. In one of the older areas is seen a distinct cyst the size of a bean; others show a trabeculated appearance, in the meshes of which is dark, clotted blood.

About the center of the tumor there is an area the size of a

half-dollar, pale yellowish in color, soft, broken down, evidently necrotic. The tumor also occupies the entire pelvis of the kidney, the only portion remaining of the same being a narrow channel at the upper and lower borders of the kidney about the size of an ordinary ureter, which join each other at the hilum, and which apparently collected the urine from the still intact upper and lower poles. The tumor does not extend into the ureter, apparently having pushed the pelvis before it in its growth.

*The microscopic examination of sections stained with Delafield's hematoxylin and eosin shows (1) in the youngest, most rapidly growing portions of the tumor large, clear, polyhedral cells; in many the protoplasm is replaced by one or more large vacuoles which represent fat (washed out by the alcohol in the process of preparing sections). Many of the nuclei have been pushed to the edges of the cell by the fat contained therein. The cells are more or less regularly arranged in columns, which are separated from each other by delicate septa of connective tissue, which passes between the individual cells, thus forming a fine reticulum in which they lie. In many places, instead of the solid septa, one sees fine capillaries separating the columns. There seems to be no regularity as to the distribution of the vessels. In some parts they are separated from each other by double layers of cells; in others by larger clusters. Along many of the septa, especially those which are formed by vessels, there is considerable free blood-pigment.*

This small growth, just described, is completely encapsulated. The capsule at no place shows any openings through which renal tissue has grown into the tumor as described by Ricker. The connective tissue of the capsule is directly continuous with that of the adjacent kidney stroma. The renal structures immediately around it show the effects of compression with consequent atrophy of glomeruli and tubules. Further away the parenchyma shows a moderate degree of inter-

stitial change. The intertubular connective tissue and that of Bowman's capsule show a distinct increase. The tumor itself bears a striking resemblance to the stratum fasciculare of the normal adrenal.

In slightly older portions of the growth, *e. g.*, the yellowish areas at the edge of the tumor, the cells show less vacuolation, the clusters of cells are much larger than in the portion just described. In places the cells are so closely packed together and irregularly placed with relation to each other and to the blood-vessels that the picture reminds one greatly of a sarcoma. According to Beneke, such a change was observed by him in one case in this class of tumors. I do not believe that one could say that such a change had occurred in our tumor, but that rather through rapid growth there was no longer any resemblance to the structure of the adrenal cortex in such portions. Here and there one sees cells with spindle-shaped nuclei which look like non-striated muscle fibers.

A section, in which the haemorrhages can be seen with the naked eye, shows microscopically cavities which have no walls, but seem to be spaces between cells of the above described type and arrangement, and which have been produced by mechanical separation of the cell-groups. In these older portions there are cross sections of large blood-vessels, and the cells seem to rise from the vessel-wall.

Such pictures may have given rise to the description of some of these growths as perivascular sarcomas, if their origin from aberrant renal tissue is not followed from more distinct fields.

Tests for glycogen were made according to the iodin method, and resulted positively. The method was as follows: Lugol's solution, 5 to 10 minims; dehydrate in one part tincture iodin and 3 to 4 parts absolute alcohol. Clear in oleum organum cretici. Mount in oil. The glycogen is distinctly seen in the form of small granules and more amorphous larger bodies of a deep brownish color. (*Phila. Med. Journal.*)

**Pathologic Histology.**—The tumor is composed of stroma and of cells; proper staining reveals the presence of glycogen ; whether they are carcinoma or sarcoma cannot be decided.

*The urine* in malignant hypernephroma shows no characteristic feature except hæmaturia.

**Clinical Features.**—These may be almost none. In the case reported by McArthur and Eisendrath, of Chicago, the features were pain of a dull character for six years, occasional hæmaturia for two years, and but mild cachexia. The right kidney was doubtfully palpable and there was some hypersensitivity over that side as compared with the left. Otherwise the physical examination was negative. Operation for stone found none, but revealed a peculiar capsular pigmentation and thickening. Following the operation the tumor grew in the cicatrix, and later the whole right kidney had to be removed.

Croftan has discovered that tissue of hypernephroma decolorizes the blue obtained with starch and iodine.

## CHAPTER XIII.

### TUBERCULOSIS OF THE KIDNEY.

We shall first consider the classification and pathology of the different varieties, then the diagnostic and therapeutic features.

**Classification and Pathology.**—Senn's classification is as follows :

1. Miliary tuberculosis.
2. Caseous nephritis.
3. Tubercular pyelo-nephritis.

**Miliary tuberculosis** is usually the result of general tuberculosis, and commonly affects both organs at once. It may be associated with a like affection of the bladder, prostate or testicles, without symptoms which are especially renal.

It is manifested by the presence of few or many minute, gray, more or less opaque tubercles surrounded by an injected border, more abundant in the cortex, and readily observed on removal of the capsule. On section linear clusters of tubercles are often to be seen continued towards the pyramids.

Occasionally by coalescence larger nodules are produced, which may present a caseous center.

Microscopically the tubercles are in some cases of the typical form and rather sharply demarcated; in others they appear more diffuse, with a partly degenerated center. The tubules in the immediate neighborhood show cloudy swelling.

**Caseous nephritis**, known also as scrofulous kidney, renal phthisis, chronic renal tuberculosis and nephro-phthisis, is located in the substance of the kidney. It may be unilateral, or both kidneys may be affected. When unilateral, the right kidney is usually the one involved. The disorder is sometimes primary.

The disease manifests itself by the extension of cheesy masses from the apices of the Malpighian pyramids upward into the cortex. At the periphery of these cheesy portions miliary and agglomerated gray and cheesy tubercles are to be seen. Microscopically we find the tubules filled with necrotic epithelium and large numbers of the tubercle bacilli. The interstitial tissue is likewise infiltrated with cells, and is ne-



FIG. 21.—Renal tuberculosis.—(FROM ROBERTS.)

crotic. Unaffected portions of the kidney become invaded by the bacilli, either along the tubules or by entrance of the bacilli into the lymphatics or blood-vessels. The apices of the pyramids become softened as the disease progresses, and a series of cavities are formed, continuous with the renal pelvis.

*Post mortem* we find the kidney usually enlarged unless it be previously contracted or fibroid. It usually gives a sensa-

tion of fluctuation, or has a doughy or mushy feel, and shows division into larger lobes or is bossellated. The capsule is usually much thickened and not easily stripped about the elevations. There may also be dense adhesion between the capsule and the pararenal fatty tissue. On section the kidney appears sacculated, and in advanced cases the intervening septa of normal tissue become more and more narrow, and the kidney may be merely a fibrous bag filled with liquid and curds, or both walls may become infiltrated with lime salts to such a degree that a calcareous shell is formed, inclosing a mortar-like material. More commonly we find the kidney enlarged, forming usually a symmetrical tumor.

*Results of the Process.*—Together with the advancement of the process in the kidney the mucous membrane of the renal pelvis, ureter and bladder is affected, and both pelvis and ureter frequently undergo extreme dilatation. Paranephritic abscess may also result from extension. Not rarely neighboring lymph glands are infected.

Amyloid kidney is not infrequently associated with unilateral caseous nephritis.

Caseous nephritis, or chronic tuberculosis, is probably more frequently descending than ascending. In the case of children Israel found one-third of all cases of pyogenic processes in the kidney tuberculous, and one-fourth of these primary. In the case of adults Riesman holds that these figures would be too high, yet claims that the kidney is more often the starting point of congenital tuberculosis than the lower genito-urinary tract. Disease of one kidney may lead to infection of the other through the circulation, or through infection via the bladder to the unaffected kidney.

At times one kidney is found to be destroyed, while the other is free from the disease.

**Tubercular pyelo-nephritis** is due (*a*), in rare cases, to escape of the contents of a primary tubercular focus in the kidney into the pelvis; more commonly (*b*) to rupture of a tuber-

cular abscess from adjacent organs, or (c) to ascending tubercular infection from below. Paraneophritic abscess is a frequent complication.

**Etiology.**—*Miliary tuberculosis* is far more common than caseous, and nearly always secondary to general miliary tuberculosis, occasionally to cases of extensive chronic pulmonary tuberculosis without general tuberculosis. It is possible that there is a primary miliary tuberculosis of the kidney, or at least one not secondary to general or advanced pulmonary disease.

For the production of tuberculosis the essentials are as follows:

1. Susceptibility of the kidney to tubercular infection.
2. Presence in the organ of tubercular bacilli sufficient in number and virulence to produce their specific pathological effect.

Clinically we find the following causes most common:

1. Antecedent inflammatory conditions, especially in the pelvis of the kidney.

2. Trauma.

By preference the disease attacks males from twenty to forty years of age, but children are not exempt. Puny adults are liable to it.

According to some authorities the disease is, on the whole, a rare one.

**Onset.**—In some cases the disease may appear with the urinary features of acute haemorrhagic nephritis, namely, blood, casts and more albumin than the blood accounts for. The writer has seen one such a case in which, however, the urinary condition was preceded for months by an evening rise in temperature. In other cases the onset is like that of a chronic vesical catarrh. Such a condition otherwise unaccounted for in children is a suspicious sign.

**Early Evidences of the Disease.**—Ascending tuberculosis may be preceded by symptoms of chronic inflammation of the lower urinary tract.

When renal or vesical symptoms appear in a patient with pulmonary or genital tuberculosis, suspect urinary tuberculosis.

When persistent cystitis exists without discoverable cause, suspect urinary tuberculosis.

Renal symptoms rarely appear before signs of trouble in bladder or prostate.

In supposed primary renal tuberculosis extension to the ureter, bladder and lower urinary tract is strong, if not positive, proof of the tubercular character of the disease, rather than presence of calculous disease, for example.

The prostate is often affected before the kidneys, and, as a rule, the testicle or epididymis first of all.

Cases, however, have been known in which pale urine, containing albumin and casts, preceded signs of trouble in testicle or prostate.

The first symptoms are usually loss of appetite and weight, fever with evening rise, and perhaps night-sweats with polyuria, and frequency of micturition, especially at night.

**Diagnosis and Clinical Features.**—There are no pathognomonic symptoms. The essentials for diagnosis are the *presence of a palpable swelling*, and the *presence in the urine of tubercular products*.

1. The first symptom is sometimes *haematuria*, which may be profuse, but, as a rule, haemorrhage is less frequent in the tuberculous than in the calculous disease.

The haemorrhages may take place any time, even at night.

The blood may first appear in clots or streaks or may be intimately mixed with the urine. (See also *Onset*.)

2. *Pain* radiating from the flank into the bladder, sometimes simulating an attack of renal colic. It is a late symptom.

*Pain* may be absent or slight in acute miliary tuberculosis and in chronic tubercular nephritis. Distressing when tubercular foci rupture into the pelvis, and when there is pyelo-

nephritis caused by ascending tubercular nephritis. Due to obstruction to the free flow of urine and to presence of tubercular products. Is severe, paroxysmal and follows ureter down to the lower urinary tract, even to the meatus and testicle, which may retract. May suggest the presence of stone in the bladder. In some cases the pain may be slight and dull in the lumbar region. Sometimes it is felt in the inner side of the thigh.

If the kidney is palpable, *tenderness* is always present, and the pain due to pressure often extends to bladder and urethra.

The pain depends on involvement of pelvis or ureter, though if the kidney parenchyma is involved alone there may be a dragging sensation. As a rule the pain is uninfluenced by motion, but is quieted by the dorsal decubitus. It may be aggravated by meals, or a blow or cold, but chiefly before the monthly period. It may be sharp, simulating stone, possibly from the excretion of purulent lumps or phosphatic concretions, or from renal congestion.

3. Associated with the pain is *dysuria*, tenesmus and constant desire to urinate.

*Strangury* may be present, even when vesical tuberculosis is absent. It may suggest presence of stone in the bladder, hence occasion frequent sounding for stone, which in this case is dangerous on account of likelihood of causing mixed infection.

4. Eventually a *resistant swelling*, apparently a symmetrical enlargement in the region of one or both kidneys.

In advanced cases there is enlargement of the kidney, which may be associated with attacks of renal colic from passage of cheesy masses, and paroxysmal hydronephrosis if the ureter is blocked by these masses.

5. More or less elevation of temperature is usually present, and the general symptoms of chronic tuberculosis, namely, irregular fever, night-sweats, progressive emaciation and debility are evident.

Not rarely chilliness or even chills may be present, fever, vomiting and symptoms of urinary septicæmia.

6. The presence of tubercular products in the urine.

**Examination of the Patient.**—In those cases in which we suspect renal tuberculosis, examine the testicles, and the prostate and seminal vesicles, by having the applicant bend over a chair or lying on a surgical table with the thighs well flexed, introduce the finger into the rectum and palpate the prostate and seminal vesicles. These usually reveal hard nodules.

**The Urine.**—1. Acid urine containing at first blood, then pus and albumin. Pus increases as disease progresses.

2. The sediment contains pus and cheesy masses insoluble in acids and by heat. Tubercl bacilli are found in some cases, especially when the ureters are catheterized.

3. To find tubercle bacilli repeated examinations of the urine may be necessary, with use of centrifuge, especially if sediment is scanty. A large amount of urine should be examined.

4. To distinguish the tubercle bacillus from the smegma bacillus use alcohol, which immediately decolorizes the stained smegma bacillus, while the bacillus of tubercle retains its stain when exposed for several minutes.

**Staining of the Bacilli.**—Smear the sediment in a thin layer on the cover-glass, dry, float film downward in anilin magenta or gentian violet, rinse with a 25 per cent. solution of nitric acid, wash off in distilled water, float slide film downward in methyl blue. The bacilli appear red in a blue field.

The stain used in Trudeau's laboratory is carbol-fuchsin, which, when washed and dried, is decolorized with twenty-five per cent. nitric acid, washed and dried, and placed for two minutes in ninety-five per cent. alcohol.

The bacilli are differentiated with such difficulty from the smegma bacillus, even with acid alcohol, that guinea-pig inoculation is the method of choice for diagnosis.

George F. Laidlaw, of New York, uses the following method for detection of the *Bacillus tuberculosis*:

1. Collect the urine for twenty-four hours.
2. Let stand for three to six hours.
3. Collect the sediment by use of a Purdy electric centrifuge, using four tubes if necessary.
4. Get rid of urates, phosphates, oxalate of calcium, pus and blood, if necessary, by measures described below.
5. Spread the sediment on a slide without cover-glass, and let it dry thoroughly in the air.
6. Holding the slide with a wooden clip fix the film by passing slowly over the Bunsen flame three times.
7. Cover the hot slide with carbol-fuchsin solution and let it simmer for two minutes.
8. Pour off the fuchsin and immerse the slide in clean water for two minutes.
9. Drop the slide in 20 per cent. nitric acid until it loses all its red color, which will usually happen in from twenty to thirty seconds.
10. Immerse again in the water to wash off excess of acid.
11. Cover the slide with absolute alcohol for three successive times, of one-half minute each.
12. Immerse again in water to wash off the alcohol.
13. Cover the slide with a one per cent. aqueous solution of methylene blue for one minute.
14. Wash off the blue in water, dry the slide in air or flame, place a drop of immersion oil on the dried film, lower the immersion lens into it and search for the bacillus.

The tubercle bacilli appear as red rods, straight or slightly curved, and sometimes beaded. The color is a light or dark red, according to the intensity of the staining. In the urine they are often found in dense groups.

Crystals of fuchsin resemble bacilli in form, and often retain their red color in spite of the nitric acid. On slowly changing the focus of the lens, the fuchsin crystal presents a

middle streak of yellow with thin black borders. The tubercle bacilli are solid red with any focus. The broken edge of a large air-bubble or forked cracks in the film may imitate bacilli closely, as they often present a red color, especially when the decolorization with acid is imperfectly carried out. They can be recognized by following along the line of the bubble or crack. It is unsafe to diagnose anything as a tubercle bacillus which lies exactly on this line. One must search further for more conclusive forms. (Laidlaw).

The search for tubercle bacilli is more likely to be successful in earlier stages, before secondary infection takes place. It is frequently difficult to find them in later stages, even when the general features of the case are well marked.

Laidlaw very cleverly gets rid of interference from various urinary constituents, as follows :

"If the urine is cloudy with urates, they must be dissolved by warming the sediment in a beaker, keeping below the point of boiling. Centrifugalize in a warm tube and spread on a warm slide. After this no precaution is necessary, as any precipitate of urates on the slide will be washed away by the staining fluids.

"The interference of phosphates must be managed by dissolving with five drops or so of acetic acid to one-half ounce of sediment.

"Uric acid is seldom abundant enough to interfere with the precipitation of the bacilli. When abundant it is not annoying, as the heavy uric acid crystals go quickly to the bottom of the tube, while the lighter corpuscles and bacilli rest above them.

"When abundant, oxalate of lime presents an obstacle. Solvents of the oxalate may destroy the bacilli. The best plan is to spread on the two slides a thick layer of sediment, oxalates and all. When they are dry, rub them together to thin down the film, and the heating over the flame will do the rest.

"Pus is the most troublesome sediment to manage. When abundant it fills up the centrifugal tubes, and the bacilli do not readily precipitate through it. For this difficulty I devised the following manipulation: To the pus add one-fourth of its volume of liquor potassæ and warm gently in a beaker, agitating it.

"The pus will coagulate and then slowly liquefy. Precipitation at the highest attainable speed will bring down a soft, bulky sediment, at the bottom of which the bacilli will be found. On several occasions I have had the satisfaction of finding the bacilli with this method after they had been sought in vain by other examiners, and where the accuracy of the diagnosis was confirmed by operation and inspection of the tubercular areas. It is to be remembered that too strong an alkali will destroy the bacilli, and it is sometimes impossible to find them in strongly alkaline, gelatinized, tubercular pus. I have determined by experiment that they resist the action of liquor potassæ in equal volume, and also one-sixth volume of a 40 per cent. solution of sodium hydrate, and one-sixth volume of aqua ammonia. In purulent urines I invariably examine the sediment before treatment with potash, as well as after.

"Treat bloody urine in the same way as the purulent."

Dr. Charles Adams, of Chicago, says: "The presence of tubercle bacilli in the urine is not always positive evidence of the existence of tuberculosis of the urinary organs, as they are often passed from other diseased organs out of the circulation by the kidneys. In the face of clinical evidence of infection of the urinary organs, failure of the bacteriological test is not to be taken as conclusive; in such cases urine-inoculation upon animals should be tried. Clinical evidence and bacteriological or inoculation tests having shown the existence of a tubercular lesion of the urinary tract, the all-important question then arises of location of the lesion. Modern diagnostic methods have facilitated wonderfully the

examination of the urinary organs. With the electro-cystoscope the interior of the bladder can be inspected, the stream of urine seen as it issues from the urethral openings in the bladder, and the ureters themselves catheterized. In the female the ureters may be catheterized by the methods of Simon, Pawlik or Kelly. In either male or female, the urine may be collected from the ureters separately by the method lately introduced by Harris, which accomplishes practically what is done by catheterization of the ureters with a simple apparatus such as can be used by any one possessed of any surgical dexterity."

**Course.**—The course is sometimes erratic. Exacerbations may occur, with moderate pain and haematuria, then all symptoms disappear until the next attack.

In many cases the order of symptoms is as follows: Back-ache, haematuria and albuminuria without casts; then putrid, alkaline urine; later, swelling, pyuria, suppression of urine, and death.

The disease may remain stationary for several years.

**Differential Diagnosis.**—In renal tuberculosis pyuria is constant when the ureter is not obstructed, and intermittent in partial obstruction, while haematuria is seldom profuse. In calculous pyelitis haematuria is profuse and pyuria intermittent.

The diagnosis of renal tuberculosis is generally unsatisfactory, unless there is a palpable swelling and the products of tuberculosis are found in the urine.

In the absence of palpable swelling and tubercular products in the urine the table on the next page should be considered.

**Prognosis.**—Always grave. If bilateral, death usually in a short time—one to three years after recognition. In primary cases life is seldom prolonged beyond two or three years, and in secondary cases death takes place much sooner. In unilateral cases the prognosis is unfavorable if the disease extends to the ureter, bladder or urethra. In rare cases recovery

**DIFFERENTIAL DIAGNOSIS IN RENAL TUBERCULOSIS, CALCULOUS PYELITIS AND RENAL CANCER.**

RENAL TUBERCULOSIS.	CALCULOUS PYELITIS.	RENAL CANCER.
Pus in the urine abundant, early and continuous. Great quantities of vibrios and micrococci. Pyuria intermittent only in obstruction.	Pus in the urine in small quantities at first, slowly increasing. Pre-coded by mucus. Pyuria intermittent.	Little or no pus or <i>debris</i> .
Hæmaturia not frequent, slight, and <i>in night urine</i> as well as day. Frequently absent for long intervals.	Occasional attacks of slight, sometimes severe, hæmaturia, after exercise none at night, or after repose.	Hæmaturia usually light at first, but later profuse. Spontaneous, continuous, aggravated at intervals; and both after repose and exercise.
Pain.—Greatest in bladder, relieved when bladder is empty.	Pain.—Paroxysmal and radiating. Worse on motion.	Pain not affected by movements.
Pyrexia more or less marked.	Pyrexia not marked.	Pyrexia not marked.
Emaciation, loss of appetite, etc.	General nutrition good.	Loss of flesh, anaemia, cachexia.

takes place in unilateral cases when lower urinary tract escapes, or when the disease is encapsulated and the cheesy matter becomes inspissated or calcareous. Complication with paranephric abscess usually hastens death.

Death is due to exhaustion and urinary septicæmia.

**Complications.**—Hydronephrosis and pyonephrosis, in unilateral cases amyloid kidney; general miliary tuberculosis. There may be rupture of the kidney followed by paranephritis or perinephritis; fistula of the kidney or of the renal pelvis may occur, and perforative peritonitis. The passage of tuberculous urine into the bladder causes vesical catarrh.

**Treatment.**—If disease is unilateral and of small area, lumbar incision may give great relief. Of late years extirpation of the affected kidney in unilateral disease has been followed repeatedly by recovery, nephrectomy being performed when the disease covers a large area.

If the bladder is extensively affected, cystotomy may in some cases prolong life.

In older cases and in bilateral ones, or with invasion of ureters and bladder, medical treatment alone must be relied on. The diet is to be nutritious and digestible, but milk is the feature.

Catheterization, sounding and washing out the bladder are contra-indicated.

The drugs to be used are as follows : A good egg emulsion of cod-liver oil, and, if the stomach tolerates it, the guaiacol carbonate, as in pulmonary tuberculosis.

For vesical distress, ammonium or lithium benzoate and salol.

When urine is alkaline and pyuria marked, and both appetite and digestion are poor, *Nux vomica*, *Nitric acid*, *Nitro-muriatic acid* may be useful.

In cases where there is much pus in the urine *lime-water* may be given, one tablespoonful in a cup of milk, two or three times daily.

**Symptomatic Treatment.**—The principal remedies are the Iodides (Arsenic, *Calcarea*, *Kali*), *China*, or *Chininum sulphate*, the Hypophosphites, *Calcarea carb.*, *Nux vomica*, *Nitric acid*, *Baptisia*, *Kreosotum* and *Nitro-muriatic acid*. Carleton also suggests *Hekla lava* and *Bacillinum*.

*Baptisia* is indicated where there is a hectic suppurative fever, disposition to well-marked chills, followed by fever and sweat, but no night-sweats ; general debility, languor, loss of hopefulness, marked anorexia.

*Nitric acid*.—Habitual looseness of the bowels, yellow complexion, morning thirst.

*China*.—Copious exhausting night-sweats, especially on forehead, neck and chest, slightly staining the linen, not offensive, occurring the moment the patient drops to sleep.

*Calcarea carb.*.—Cold, clammy extremities, great chilliness, loss of strength and flesh, great mental depression.

**Special Therapeutic Measures.**—For strangury, sitz-baths and rectal suppositories of Opium, *Hyoscyamus*, *Lupulin* or *Belladonna*.

For the chills and fever, Aconite, Baptisia, China and Quinine. Iced champagne for the nausea and vomiting of threatening uræmia. When uræmia threatens, give jaborandi, as previously described, or use warm baths or packs, and open the bowels.

Cold sponging for the pyrexia. Diarrhœa, unless patient is uræmic, should be checked.

#### TYPICAL CASE.

In the case of a woman which the author saw there was palpable swelling (tumor in the right side, lying just above a line drawn through the umbilicus), great sensitiveness on pressure, frequency of urination (but no strangury), fever, night-sweats and weakness. Vaginal examination revealed slight sensitiveness of the bladder to pressure. Examination of the urine revealed presence of tubercular bacilli.

The whole twenty-four hours' urine was obtained, and the results were as follows:

Quantity of urine, 750 c.c. (25 fluidounces); specific gravity, 1.021; reaction, acid; to talurea, 306 grains (20 grammes); total phos. acid, 16 grains (1 grammie); albumin, 15 per cent. bulk; pus, 6 per cent. bulk.

Sediment.—Great abundance of pus and some blood-corpuscles (blood-shadows, mostly); no casts; numerous micro-organisms; tubercular bacilli.

The features in this examination were the high ratio of urea to phosphoric acid, the large amount of albumin compared with the pus, the absence of casts, and the presence of tubercular bacilli. Cheesy masses, insoluble in acetic acid, were not found.

This case terminated fatally (without medical or surgical treatment, so far as I know) in about two months from the time that the diagnosis was made.

In a case in which the writer examined the urine for Dr. McBurney, of Chicago, after removal of the diseased kidney,

the other kidney excreted eighty fluidounces of urine in twenty-four hours.

**Surgical Treatment.**—According to Ramsay primary renal tuberculosis may be classed as a semi-malignant form of inflammation, and for this reason surgical treatment is always indicated. (2.) This surgical treatment will have a palliative or curative end in view, depending upon the condition of the patient and the extent of the local pathological process. (3.) Nephrotomy in renal tuberculous processes is to be designated as a palliative operation, with the chief aim of the immediate relief of grave symptoms, it does not preclude a secondary nephrectomy, and coupled with free evacuation and drainage of abscesses is a most valuable procedure. (4.) Resection of a diseased portion of a tuberculous kidney is a most dangerous procedure, because it is not always possible to take out all of the disease and a focus so left behind may infect the other kidney or the system at large, or both. (5.) Nephrectomy or nephro-ureterectomy is distinctly indicated in every suitable case, and in suitable cases should result in permanent cure in 55.5 per cent. of all cases. (6.) The indications against nephrectomy are tuberculous disease of the other kidney or of other organs in the body. (7.) Tuberculous disease of the bladder is not to be considered a contraindication to nephrectomy because it will probably heal later. (8.) A small tuberculous focus in the lung, provided the patient is otherwise well, is not to be considered as a contra-indication. (9.) In cases of doubt as to whether a patient can stand an immediate nephrectomy, it is best to do a nephrotomy and leave the nephrectomy to a later date. (10.) The clamp method of managing the pedicle is contra-indicated on account of the danger of haemorrhage upon removing the clamp. (11.) It is safest to remove the ureter with the kidney, as a persistent fistula may give trouble if it be allowed to remain in the body. (12.) The majority of these fistulæ tend to heal either after the removal of a deep suture or after

the slow disappearance of tubercular disease along the ureter, which then becomes a fibrous cord. (13.) We may expect an increasing number of cures as our means of diagnosis improve and our surgical technic is carried out more scientifically and carefully.

In a case of unilateral primary tuberculosis in a woman in which nephrotomy was performed by Adams, *ureteral irrigation* with weak solutions of Formalin and Iodine was used after operation, and perfect recovery took place.

## CHAPTER XIV.

### DISEASES OF THE RENAL PELVIS.

We find the renal pelvis subject to the following :

1. Malformation.
2. Dilatation.
3. Hyperæmia.
4. Hæmorrhage.
5. Oedema.
6. Inflammation.
7. Tuberculosis.
8. Tumors.
9. Cysts.
10. Calculi.
11. Parasites.

**Malformations of the Pelvis.**—The ureter and the pelvis may be absent, or the pelvis small or defectively formed, and the ureter affected by stenosis. Valve-like folds have been found in both, as also bending of the ureter; the pelvis and ureter may each be doubled, or in some cases the ureter may begin in three divisions which join to form one tube, or the ureter may open in abnormal places—in the prostatic urethra, the vagina, the uterus, the female urethra, the intestine or the seminal vesicle.

### HYPERÆMIA OF THE PELVIS.

Active hyperæmia of the mucous membrane of the renal pelvis and ureter is found in cases where irritants are eliminated in the urine and also in inflammations.

Passive hyperæmia occurs in thrombosis of the renal veins and may lead to hæmorrhage.

**Oedema** occurs in this and in inflammations.

**Dilatation of the Ureter and Pelvis** is caused by conditions interfering with the proper discharge of the urine. The latter accumulates and gradually distends the pelvis and calices causing *hydronephrosis* so-called. The ureter is also distended as far down as the obstruction. It may be partial, especially if the kidney has two pelvis and two ureters, only one being affected. When the obstruction is complete, the term *closed hydronephrosis* is used, when incomplete *open hydronephrosis*.

#### HYDRONEPHROSIS.

**Synonym.**—Nephrohydrosis.

**Definition.**—Dilatation of the kidney, its pelvis and calices, usually unilateral, rarely bilateral.

**Etiology.**—Obstruction to the outflow of urine due to the following causes :

1. Contraction of one or both ureters, unless resulting from inflammation, ending possibly in obliteration of the canal.

2. Compression of the urinary tract below the pelvis, as by tumors.

3. Obstruction from (*a*) congenital causes, as atresia, congenital folds or twists, or oblique insertion of the ureters, or more commonly from (*b*) acquired causes, as inflammatory processes around the ureter; displacement of the uterus; uterine, ovarian or rectal tumors which compress or constrict the ureters; or from (*c*) result of causes within the urinary tract, as inflammation, stricture, enlarged prostate, calculi, tumors, blood-clots, parasites.

4. Miscellaneous causes :

Masses of uric acid crystals in the ureter may cause it in children. Pressure upon the ureter by an over-filled rectum or bladder in a pelvis contracted by rickets or osteo-malacia may cause it. Diseases of the bladder involving the ureteral orifices are also a cause. Valve-like effects produced by movable mucous membrane of the pelvis when inflamed is some-

times a cause. It also is said to be a result of traumatism, but this may be really a pseudo-nephrosis, the urine being in the retro-peritoneal connective tissue and not in the pelvis.

Congenital hydronephrosis is most frequently due to stricture of the ureter; it may be due to absence of the ureter or urethra, or to compression by an anomalous renal artery, to an anomalous opening of the ureter into a valve in the ureter or pelvis. Congenital phimosis may produce hydronephrosis; horseshoe kidney is occasionally hydronephrotic because of a sharp bend in the ureter.

Hydronephrosis may also be due to peritoneal exudates. Congenital hydronephrosis may be an obstruction to labor; it is often associated with club-foot, hare-lip, etc., and is frequently bilateral.

Clinically we find *urethral stricture, enlarged prostate, renal calculi and displacements of the kidney* among the commonest causes. Landau holds that spasmodic contraction of the ureter is a noteworthy cause.

**Occurrence.**—The disease is more common among women than among men, and may not be suspected during life. A common sequence is the following: Retroflexion or prolapsus of the uterus, pressure upon the ureter, hydronephrosis, chronic interstitial nephritis or atrophy (or pyonephrosis and pyelonephritis). Floating kidney by torsion of the ureter may cause hydronephrosis. It is more often acquired than congenital. It develops most readily when the obstruction is either intermittent, or of slow development.

An acute complete obstruction is not followed by hydronephrosis of any considerable degree, but soon leads to an arrest of secretion by counter-pressure (Riesman). In cases of slowly-developing hydronephrosis the accumulation continues until the counter-pressure exceeds the pressure of secretion.

Hydronephrosis may be bilateral. In 655 cases of acquired hydronephrosis Newman found 448 bilateral; Morris found

106 bilateral cases out of a total of 142; Roberts, 13 bilateral cases out of 20. Nevertheless it is said by some writers that it is more usually unilateral. The latter, however, should not be assumed by the surgeon in operating.



FIG. 22.—Hydronephrosis; second stage; the kidney substance completely atrophied—  
(LE DRNTU)

**Pathologic Anatomy.**—We find a cystic tumor, the shape of the kidney, and in its site, composed chiefly of the dilated

renal pelvis and calices, the kidney more or less atrophied, appearing as an appendage to the pelvis.

The interior of the sac is composed of communicating smaller sacs, (dilated calices), at the bottom of which are seen the flattened pyramids.

The sac contents are a liquid of low specific gravity resembling the urine of chronic interstitial nephritis. In cases of long duration neither urea nor uric acid may be found in it. If there is complicating haemorrhage or inflammation, blood, pus, cholesterin, fat or chalky substances may be present, otherwise no sediment.

In some cases the cyst appears as large as an abdominal tumor, containing several gallons.

If the tumor is very large, the abdominal organs are likely to be displaced, and the colon may lie on the tumor or at one side of it.

As the dilatation progresses, chronic fibrous (interstitial) nephritis arises in the kidney; later, atrophy of the kidney.

If the obstruction is in the ureter, the latter may become so dilated as to suggest that it is the small intestine.

In advanced cases the kidney may be so altered that scarcely any renal tissue remains, and there is only a huge sac filled with fluid.

**Pathologic Histology.**—In the beginning the pyramids are flattened from pressure, and there may even be necrosis of the apices; the renal epithelium shows cloudy swelling, later fatty change; many are desquamated and disappear, but there is usually also evidence of attempts at cell-multiplication. Coincidently with degenerative changes in the epithelium the connective tissue increases and compresses the glomeruli and tubules. Finally there is only a huge sac filled with fluid. (Riesman.)

**The Fluid in Hydronephrosis.**—The liquid is of low specific gravity, 1.002 to 1.012, and never alkaline when fresh. Urea may be found, though not always. A relative abun-

dance of sodium chloride is present. The neutral or acid reaction of the aspirated fluid is an important point when urea and uric acid are absent.

Albumin is sometimes present; epithelia from the pelvis and kidney are found, and sometimes red blood-corpuscles. In old cases the fluid may have become gelatinous. Infection of the fluid results in pus formation (pyonephrosis), and cholesterol-plates may then be found in a gruel-like substance.

The fluid may amount to several liters, is urinous, but deficient, as compared with urine, in urea, chlorides and phosphates.

**Varieties.**—We distinguish *intermittent hydronephrosis* as one which disappears with removal of the cause of obstruction, but recurs again with the cause, and *remittent hydronephrosis* in which the condition is persistent, but subject to increase and diminution.

The term *closed hydronephrosis* is used in cases in which the flow of urine is completely interfered with, and *open hydronephrosis* when only partially.

**Diagnosis.**—A fluctuating tumor in the region of the kidneys, which diminishes in size when the urine increases in amount, points to hydronephrosis of the intermittent variety. A tumor persistently present, associated with obstruction to the free flow of urine, also suggests this disease.

**Clinical Features.**—We may find some one of the following:

1. Gradually forming tumor; no symptoms, and no lesion recognized except post mortem.
2. Constant, dull, dragging pain in the loin over affected kidney, lasting a long time, and development of fullness or tumor.
3. Intermittent hydronephrosis: temporary diminution in quantity of urine per twenty-four hours, possibly vomiting and fever for a few days, followed by polyuria, possibly haematuria and relief. Such hydronephroses tend to re-accumulate and may be repeated indefinitely.

4. Large tumor, unilateral or bilateral, filling greater part of abdomen; smooth, resistant; transmits sense of fluctuation; pain extending to thigh; persistent constipation and dyspnoea may accompany it.

5. Double hydronephrosis with progressive enlargement; symptoms of chronic fibrous nephritis, as chronic uræmia.

Bilateral cases are almost always congenital and cause death from uræmia in a few days at most.

Hydronephrosis in cases of movable kidney may show itself by the disappearance of the tumor on passage of much clear urine.

Not rarely, and especially in bilateral cases, there are uræmic and septic symptoms, as chills, fever, nausea, vomiting, headache, and even convulsions. Paraplegia occurs as a complication in some cases.

**The Urine.**—Unilateral hydronephrosis: the sound kidney excretes normal urine.

**Bilateral.**—Normal urine until close of life, then that of chronic fibrous nephritis.

In intermittent hydronephrosis a large tumor suddenly disappears with the simultaneous passage of a large quantity of urine.

**Differential Diagnosis.**—The renal nature of tumor may be suspected from the seat, especially when the colon lies in front of it. The colon in such a case, when empty, may be felt as a movable cord, and can be distended by inflating the intestine. The larger the tumor the more likely the colon to be displaced laterally. Aspiration withdraws a fluid containing urea and uric acid, except in unilateral cases of long standing.

In young children it is difficult to distinguish sarcoma of the kidney and enlarged retroperitoneal glands from hydronephrosis.

Hydronephrosis is to be distinguished from ovarian cystoma. The ovarian tumor is more freely movable, fills the lower portion of the abdomen and tends to push the intestines

upwards, while in hydronephrosis the ascending colon can often be made out passing over the hydronephrotic tumor. Aspiration may, in the case of an ovarian cyst, reveal Graafian cells.

Hydronephrosis is distinguished from pyonephrosis by the absence of constitutional symptoms.

In rare cases a large hydronephrosis has been mistaken for ascites, while the combination of movable kidney and hydronephrosis occurs. Aspiration and examination of the fluid may therefore be of service in doubtful cases, except when the disease is of long standing.

It may be difficult to distinguish hydronephrosis from hydatids of the liver or kidney unless, by aspiration, the scolices and hooklets can be found, as in the case of hydatids.

**Course.**—Acute hydronephrosis may last from a few hours to a few days. Chronic cases may persist for years or even for a life-time.

**Prognosis.**—*Unilateral:* Produces merely mechanical discomfort. *Intermittent:* not essentially serious. *Bilateral:* if progressive, prognosis unfavorable, like chronic fibrous nephritis.

In congenital cases death takes place at birth, or in a few months or years.

When due to renal calculus or uterine displacement, prognosis depends on the cause.

A majority of the cases never cause trouble. A certain proportion are cured by spontaneous evacuation. In some cases the growth of the tumor is such as to require surgical interference; the same is true when infection and transformation into pyonephrosis take place. A few cases of intra-abdominal rupture, or even evacuation through the diaphragm and lungs, have been reported. Rupture of the pelvis of the kidney occurs, but is rare.

**Usual Causes of Death.**—Suppression of urine, rupture of the sac into the abdomen, or interference with the functions

of other organs. Suppurative pyelo-nephritis and death may follow operations on the lower urinary tract when hydronephrosis is present.

**Treatment.**—If due to lesions, such as displacements, renal calculi, etc., careful manual pressure, emptying the sac, friction over tract of ureter or on the sac, hot baths, etc. If due to pelvic tumors, lower bowel to be emptied daily; support of tumor as in prolapsed uterus by pessaries. If tumor rapidly increases and cannot be emptied by ordinary pressure, surgical means necessary, as tapping, nephrotomy, or nephrectomy. Landau thinks nephrectomy contra-indicated. Recently another mode of operating has been tried, viz., stitching the sac to the skin. J. K. Thornton holds that if the fluid re-accumulates after several tappings, nephrectomy is preferable to nephrotomy and drainage.

Aspiration affords temporary relief, and by repetition sometimes cures. The needle is to be inserted, if on the right side, two and a half inches behind a line perpendicular to the anterior superior spine of the ilium, and midway between the crest of the ilium and last rib. On the left side an inch higher up. Strict antiseptic precautions are necessary. Incision and drainage are often preferable.

Medical treatment of this disorder is practically unavailing. In women a carefully adapted belt and band may be used to prevent recurrence.

Congenital bilateral hydronephrosis cannot be relieved by treatment. Unilateral cases are sometimes tapped, but there is serious risk of rupturing the sac or producing peritonitis. In rare cases the fluid can be forced out by manipulations.

Acquired hydronephrosis has been relieved by massage; some danger attends this measure, as too much force may rupture the sac.

Intermittent hydronephrosis, due to movable kidney and kinking of ureter, may be relieved by nephorrhaphy.

Nephrotomy is rarely fatal, but in more than half the cases produces permanent fistula.

Nephrectomy has had a mortality of forty-one and three-tenths per cent.

For hydronephrosis, which is of long standing and with absolute closure, nephrectomy is the better operation unless the occlusion can be relieved. Recent hydronephrosis calls for nephrotomy, fixation to the lumbar fascia and drainage. The operation is useful in intermittent hydronephrosis due to kinking of the ureter.

For *nephrotomy* the best incision is the oblique, because it splits the muscles instead of cutting them.

In *nephrectomy* the most convenient incision is the oblique one. The fatty capsule is stripped off from the kidney, the vessels separately ligated, and, when practicable, the ureter should be ligated, disinfected and dropped. The chief difficulties encountered are in dealing with the vessels and in avoiding cutting into the peritoneum. Nephrectomy may be not rarely complicated by the fact that the renal pelvis may adhere to the stomach or adjacent loops of the intestines.

#### PYONEPHROSIS.

**Definition.**—Dilatation of the pelvis of the kidney with urine mixed with pus. The term is also used to describe the condition of the kidney when, from renal abscess, it becomes converted into a pus-sac.

**Etiology.**—That of hydronephrosis, which has become the seat of suppurative inflammation. Stone, tuberculosis, injuries, septic inflammation, and malignant disease of neighboring organs are common causes. It is said, however, to occur, like pyelitis, in the course of acute nephritis, diphtheria and other infectious diseases.

Careless aspiration of hydronephrosis, rupture of renal abscess, and obstruction of the ureter by tuberculous, cheesy masses or by blood-clots, and ascending gonorrhœal infection obstructing the ureter are causes.

*Clinically we find impaction of stone in the pelvis a common cause.*

**Pathologic Anatomy.**—That of hydronephrosis, except that the sac contains pus in addition to urine, and instead of a smooth, shining, grayish-white wall, there is a rough, opaque-yellow, perhaps granular or ulcerated wall.

**Clinical Features.**—Those of hydronephrosis, except that the tumor rarely attains so large a size. Persistent pyonephrosis has the symptoms of suppurative pyelitis. Evacuation of the tumor, like that of hydronephrosis, may take place into the intestine, pleura or lungs.

Aspiration will show presence of pus.

**The Urine.**—In intermittent pyonephrosis the diminution in size of tumor is associated with presence of pus, blood and albumin in the urine. The presence of large amounts of fat in the urine has been noticed in this disorder, as well as in paranephritis.

**Course.**—The duration of this disorder is from three months to several years, usually not longer than three years.

**Differential Diagnosis.**—Pyonephrosis is differentiated from hydronephrosis by smaller size and presence of pus; from circumscribed peritonitis by presence of pus in the urine; from solid abdominal tumors by aspiration.

**Causes of Death.**—Death soon follows rupture into retroperitoneal tissue, peritoneal cavity, or thorax. Death may follow inflammation induced in renal substance or neighboring parts. The patient may succumb to slow, gradual exhaustion and anaemia with low fever, symptoms of amyloid degeneration of various organs, pyæmia and septicæmia.

**Prognosis.**—*Unfavorable*, if primary disease is tuberculosis of renal pelvis or bladder, or malignant disease of uterus or rectum.

*Unfavorable*, if distension of the renal pelvis is rapid and due to sudden impediment in escape of pus; the danger to life is in such cases great, unless surgical interference is possible (nephrotomy or nephrectomy).

*Unfavorable*, if urine is alkaline and there is vesical irritation.

*Not immediately unfavorable*, if urine is acid, pus in small bulk in the renal pelvis, obstruction and suppuration unilateral in otherwise healthy patient.

Pyonephrosis is essentially a chronic disorder, and the pyuria and haematuria may continue over a long period of time.

*Favorable*, if tumor ruptures into some part of conducting portion of urinary tract, and at the same time no grave structural change has taken place in the affected kidney.

*Amelioration*, if rupture takes place into alimentary canal; there is constant danger of acute peritonitis.

*Recovery* has been known to take place when formation of pus ceases, and the sac contracts on a cheesy mass.

**Treatment.**—Attend to cause of obstruction; displacements of pelvic organs, tumors, renal calculus, urethral stricture, enlarged prostate, etc., must be looked for and, if possible, remedied. If the purulent discharge from the kidney is found intermittently in the urine, and there are signs of calculous obstruction, keep patient at rest on a sofa or specially constructed couch and administer diluents, as distilled water, freely. If the urine is over-acid, give alkaline waters, corn-silk, lithia and *Terebinthina*. If alkaline, render acid with Boracic acid, unless the irritation is primarily due to uric acid as shown by history, in which case alkalies may prove more serviceable. If swelling increases in bulk and there is more pain, and pus is not freely found in the urine; if fever, gastric symptoms, rigors, sweat and emaciation are noticed, together with evidence of extension of the inflammation, then surgical interference is immediately required. First, *nephrotomy* with free antiseptic drainage at point of election *behind*. If the purulent discharge from the sinus is continuous and undiminishing, nephrectomy is to be performed when the patient has recovered from the pyæmic condition. Mortality is lower, when there is no calculous obstruction.

Massage, with ingestion of large quantities of fluids, has, according to Carleton, been successful in some recent cases.

#### HÆMORRHAGE.

This is due to inflammation, passive congestion, infectious diseases, hæmorrhagic diseases, injuries, stone, parasites or tumors.

#### PYELITIS.

**Definition.**—Inflammation of the mucous membrane of the pelvis of the kidney. May occur without pyelo-nephritis, or the latter may result from it.

**Etiology.**—Pyelitis is essentially a secondary disorder of bacterial or toxic origin. It is said that it may occur primarily, but such cases are undoubtedly rare. We find commonly the following causes :

1. Hæmatogenous infection of the pelvis from diphtheria, typhoid fever, scarlet fever, small-pox, measles, cholera, acute nephritis and possibly gonorrhœa. It accompanies pyæmia, scurvy and enteric fever.

2. The result of irritation due to the elimination of certain poisons, as copaiba, turpentine, cantharides, and cubebs. Glucose acts as an irritant also, and we find a diabetic pyelitis.

The above causes usually produce mild cases which may escape notice altogether ; more severe cases may be due to the following :

3. Extension of inflammation downward from the kidney-substance, or upward from the lower urinary tract, or rarely from neighboring parts. Most commonly it is due to urethritis or cystitis, sometimes to acute or chronic nephritis or tuberculosis of the kidney, less commonly to paranephric or perinephric abscess rupturing into the pelvis.

4. Presence of some foreign body, as calculus, tumor, blood-clot or parasite. Obstructed ureter and sarcoma are common causes under this heading.

Cases thought to be primary may eventually be found due either to tuberculosis or stone. It is said, however, that there is a pyelitis due to "catching cold."

Pyelitis is quite commonly due to extension of inflammation in cases where there is obstruction to the free flow of urine, as in stricture or enlargement of the prostate, the inflammation in these cases showing a marked tendency to ascend; cystitis from paralysis in spinal diseases also causes ascending pyelitis.

Any case of urethritis or cystitis, if it last long enough, may advance upward to the ureters and pelvis, so that in severe cases we often find an inflammation of the whole urinary tract, *pyelo-cystitis* so-called, and even ureteritis and suppurative nephritis at the same time.

Pyelo-cystitis may develop in low grade genito-urinary infections from sudden relief of prolonged retention, exposure to cold, shock or operative trauma. Infection alone in such cases does not wholly account for the condition. Circulatory disturbances, internal blood metastasis or traumatism is necessary to virulent development. (Lydston.)

The danger of onset of pyelitis is always great when, for any reason, there is urinary stasis. It is common in diseases of the kidney parenchyma, especially passive hyperæmia, acute diffuse and chronic diffuse nephritis.

In pyelitis secondary to cystitis the ureter is often slightly or not at all affected, the urine in the pelvis being infected by the agent. The occurrence of an ascending pyelitis without a previous cystitis is possible.

In acute pyelitis we find the *Bacillus coli communis* most commonly the cause. In general, pyelitis is due to the presence in the pelvis of the kidney of an irritant, either bacterial or toxic.

Cases arising from child-birth or following diseases of the sexual organs are likely to be due to infection from either the bladder or the kidneys. Cases are cited referable to constipation merely as a cause, in which case the colon bacillus is thought to be the exciting cause.

**Pathologic Anatomy.**—The disease may affect one kidney, but is usually bilateral.

There are several pathological classes of pyelitis, as follows:

1. *Catarrhal*.—Swelling, thickening and injection of the mucous membrane, with sometimes punctate haemorrhages and turbid residual urine in the pelvis, containing leucocytes and detached epithelia.

2. *Suppurative*.—Thickened, discolored, mucous membrane with less conspicuously injected blood-vessels, but pus is present in the urine in the pelvis, and the mucous membrane may be ulcerated.

The pelvis is more or less distended and filled with purulent urine. Microscopically we find round-cell infiltration, hyperæmia and desquamation of the pelvic epithelium. In advanced cases (pyelo-cystitis), those due to stone or other causes, ulceration, gangrene and perforation may take place. In these cases there is usually also pyelo-nephritis.

If nephritic abscesses burst into the pelvis, ulcers form and may penetrate deep into the renal tissue (pyonephrosis).

3. *Pseudo-membranous* or *diphtheritic*.—Not rare in cases in which the urine contains virulent bacteria. In such cases we find superficial necrosis, with deposit of salt; apices of pyramids necrotic or destroyed.

4. *Hæmorrhagic*.—Cases in which haemorrhages into the inflamed membranes occur.

**NOTE.**—The pathological condition in the ureter and bladder usually corresponds to that of the pelvis, but the ureters may evince evidence of only catarrhal inflammation when both bladder and renal pelvis are affected by the other lesions.

*Chronic pyelitis*.—We find the mucous membrane thickened and ridged; sometimes a papillary hyperplasia occurs, and rarely a peculiar cyst formation; at other times the mucous membrane is epidermatized and becomes horny and shiny, a condition termed cholesteatoma. (Riesman.)

Chronic pyelitis, with retention of urine in the pelvis and dilation, may result in secondary contracted kidney.

**Occurrence.**—More frequent in men and in adult life.

**Clinical History.**—The most common clinical history is that of stricture or enlargement of the prostate; quite commonly also we may find that the patient has had gonorrhœal cystitis or a renal calculus. The infection may be due to use of unclean instruments. In some cases local tuberculosis is the history.

The milder forms of pyelitis are those of the acute infectious diseases, the puerperal state, from poisoning, and in mild cystitis. The severe forms are pyelo-cystitis and pyelo-nephritis from stricture, paralysis of the bladder in spinal diseases, and from new growths or parasites of the kidney.

**Diagnosis.**—A severe disease of the urinary passages with fever points to pyelitis and pyelo-nephritis; whether the pyelitis is unaccompanied by pyelo-nephritis may be inferred from the history and absence of micrococcus casts in the urine, together with, as a rule, less severe general symptoms.

The diagnosis depends upon the local alterations in the kidney (feeling of tension, pressure, pain, or pain on pressure) and changes in the urine (presence of mucus or pus).

**Clinical Features.**—The symptoms may be masked by those of the disease of which it is a complication, or before suppuration may be altogether insignificant. The most common features are as follows, in the cases before suppuration :

Dull pain in the region of one or both kidneys.

Sensitiveness on deep pressure.

Possibly moderately severe pain following course of one or both ureters.

Usually little or no constitutional disturbance. There may be nocturnal transitory fever, especially during attacks of pain. Sometimes decided chills and sweating. Absence of pain does not exclude pyelitis.

Usually the patient complains of a feeling of tension or

pressure in the region of the kidneys. Pain may be present and is worse on pressure. Pain may be absent, but brought on by pressure over the region of the kidneys.

*The urine* is acid in reaction, cloudy, contains a small quantity of albumin, a few per cent. only by bulk, and a small amount of pus, with a few blood-corpuscles. No casts are found.

In some cases only an exaggerated mucous cloud may be noticed in the urine.

When the case proceeds to suppuration the following symptoms appear :

Chills with a decided rise in temperature ; in severe cases, a septic temperature with very marked accessions and remissions, and repeated chills persisting ; in milder cases, a small evening rise, dropping to normal the next morning, especially in tuberculous pyelitis.

The patient after a time is anaemic, loses flesh and strength, has loss of appetite, night-sweats, and a constantly elevated temperature. Marked remissions occur and the disease may last for many years.

*The urine*, after suppuration is established, may contain so much pus as to be almost milky. In cases due to septic inflammation of the lower urinary tract we find small gelatinous masses in the urine composed of rod-shaped bacilli and a little calcium oxalate. While the freshly-voided urine may be acid, it soon, in standing, becomes alkaline and deposits triple phosphate.

In general the urinary features of *chronic pyelitis* are as follows :

1. Quantity increased ; polyuria.
2. Color decreased or of a greenish tint.
3. Odor slightly like that of rotten eggs.
4. Solids deficient ; specific gravity diminished.
5. Triple phosphate crystals found even in acid urine (incomplete forms).

6. Pus present as in acute, with albumin corresponding. The pus-corpuscles have tooth-like projections and red blood-corpuscles are decomposed.

7. Micturition may be frequent, but is usually painless.

In cases where pyelo-cystitis leads to secondary contracted kidney, we may find in addition a few hyaline casts.

See also Renal Calculus, Cancer, Tuberculosis and Cystitis for urinary features.

Casts may be from the mouths of the urinary canaliculi (*ductus papillares*), which are involved in all but the milder cases of pyelitis. Pus casts and casts of cocci occur in septic cases, as in pyelo-nephritis.

If the pyelitis is unilateral, the flow of purulent urine may be followed by that of a normal urine, due to temporary obstruction of the ureter continuous with that of the diseased pelvis. Catheterization of the ureter demonstrates the existence of such a condition.

Downes (Philadelphia) presents a new instrument for the collection of the separate urines which he calls the "Separate-Urine Siphon." It is a modification of the Harris segregator, in that the suction apparatus is dispensed with, and the instrument further simplified in other ways. It is made of two parts—a double-barrelled bifurcating catheter of small calibre (13 American scale), and a partition-rod which elevates the bladder-wall between the catheter ends for fully 2½ inches. The rod differs for the sexes, and is attached to the end of the shank of the catheter by a small fixed clamp and thumbscrew. Movement of the beaks during introduction of the instrument into the bladder is prevented by a little fixation-pin.

In all cases where instruments are used the patient should rest for forty-eight hours, and take Salol in five-grain doses beforehand.

In *pyclo-cystitis* the urine will gradually become ammoniacal, and be opaque, stringy and of a dirty color, resembling in other features also that of cystitis.

**Clinical Varieties.**—The clinical features above described apply chiefly to acute primary, and chronic primary pyelitis. Other forms of the disease with their features are as follows:

**Traumatic Pyelitis.**—In slight injury, few symptoms, slight haematuria ; more serious cases, pyæmia and pain. The prognosis is generally favorable. Some cases may require nephrectomy.

**Neurotic Pyelitis.**—Occurs in neurotic girls ; the features are slight lumbar pain and intermittent haematuria. Prognosis good. The disease lasts but a few days and terminates in recovery.

**Calculus Pyelitis.**—Due to presence of one or more stones in the renal pelvis. It is usually a chronic condition. The features are, first, pyuria, which may be symptomless for years ; pain in the region of the kidney and enlargement of the kidney. More or less blood is usually found and may form a thin, reddish layer on top of the heavier pus sediment.

**Tubercular Pyelitis.**—May be subacute in form, without much pain or fever. There is pale, acid urine of low specific gravity containing pus and albumin. In some cases tubercle bacilli may be found in the urine, especially in early stages.

**Ascending Pyelitis (secondary pyelitis).**—Acute cases are due to injudicious use of instruments on the lower urinary tract in patients either lithæmic or tuberculous, or may result from the sudden removal of a hydronephrosis in cases of enlarged prostate. It may terminate fatally in less than ten days. Subacute cases may follow gonorrhœa and are seldom fatal.

The clinical features in these cases are sudden rise in the temperature of the body, dull pain in the region of the kidneys, frequent urination, or rapid suppression of urine. The latter is usually of acid reaction and cloudy from swarms of micro-organisms and pus.

Chronic cases are essentially those of cysto-pyelitis or pyelonephritis, and occur in the case of enlarged prostate, chronic cystitis, spinal disease, stone or tumors.

**Differential Diagnosis.**—Pyelitis is to be differentiated from pyelo-nephritis and from cystitis as follows :

PYEO-NEPHRITIS.	PYELITIS.	CYSTITIS.
Alkaline urine.	Acid.	Acid or alkaline.
Absence of tenesmus ves- icæ.	Absence of tenesmus.	Vesical tenesmus.
Albumin sometimes abundant.	Albumin seldom abun- dant.	Albumin seldom abun- dant.
Constitutional symptoms marked.	Constitutional symptoms not marked at first.	Constitutional symp- toms not marked.
Pain over the renal region.	Pain over the renal region.	No pain over renal region.

In chronic pyelitis there is sometimes polyuria, suggesting chronic interstitial nephritis, but pain over the region of one or the other kidney and absence of the cardio-vascular symptoms serve to differentiate.

A sharp line between pyelitis and cystitis can not always be drawn owing to the fact that inflammation of both renal pelvis and bladder may co-exist ; the same may be said of pyelitis and pyelo-nephritis. The above table is seldom of much clinical value.

Pyelitis may sometimes be distinguished from cystitis by the fact that in severe cystitis the limit of the amount of albumin is 0.1 per cent. by weight ; in pyelitis the pus-corpuscles in the urine are crenated and the red blood-corpuscles show evidences of decomposition.

Pyelitis is often associated with hydronephrosis, in which case there is severe renal pain coming on suddenly, with chills, fever, vomiting and diminished amount of clear urine. The symptoms subside when the obstruction is relieved.

**Course.**—The course is that of the primary disorder, hence may be acute, subacute and chronic. Pyelo-cystitis is a tedious disease which may last for years. Chronic pyelitis is likely to be complicated by pyelo-nephritis, with termination in uræmia, urinary septicæmia, rupture or amyloid kidney.

**Prognosis.**—1. *Favorable*, when due to bacterial poison of

infectious diseases or to toxic irritants; except when due to acute nephritis, cholera or diphtheria, where prognosis is grave.

2. *Serious*, when pyelo-nephritis results, though even then recovery is possible.

3. *Serious*, when associated with grave vesical disorders, owing to danger of pyelo-nephritis.

4. *Serious*, when after chronic pyelitis of long duration, amyloid disease or chronic interstitial nephritis results.

In general, in severe urinary diseases, when pyelo-cystitis is established it becomes a tedious and incurable malady.

Pyelitis due to stone has a more favorable prognosis in a subject well suited to operation.

The prognosis in chronic pyelitis is unfavorable where an acute pyelitis develops.

**Treatment of Pyelitis.**—In general it may be said that the following measures should be taken :

1. "Judicious management of any infectious fever present." (Anders.)

2. Removal of any inflammatory cause, including stricture or enlarged prostate.

3. Rest, regulation of the diet, avoidance of sexual excess.

4. Use of urinary antiseptics, balsams and astringents.

5. Hot applications or plastic dressings.

6. Free use of diluents and demulcents, as fresh buttermilk, boiled milk with lime-water, Vichy water, etc., etc.

7. Avoidance of irritating diuretics and unnecessary surgical examinations.

8. Administration of any remedy indicated symptomatically.

The essentials of general treatment are as follows :

Confinement to bed in acute cases.

Great care to be taken to avoid chilling of surface of body.

Avoidance of sexual intercourse.

Non-nitrogenous or largely farinaceous diet. In severe

cases absolute milk diet, as long as fever lasts. Milk diet is also best for the chronic suppurative or tuberculous forms.

Long-continued lukewarm baths during exacerbations.

Unless the polyuria is excessive, patient should drink very freely of water. French Vichy is an excellent water in pyelitis.

Satterthwaite suggests that the patient sit over a steaming decoction made by putting a bunch of wormwood in a chamber or other receptacle in a closed water-closet-chair, and then pouring on it boiling-hot water.

In severe cases where pain is a feature, application of warm poultices or of antiphlogistine over the region of the kidneys should be made.

It goes without saying also that treatment for the primary inflammatory disease is indicated. Timely treatment for cystitis may prevent the onset of pyelo-nephritis.

Urethral stricture or enlarged prostate must be removed. If the case depend upon an infectious fever "judicious" treatment of the latter is necessary. Irritating diuretics must be avoided in the treatment.

**Remedies.**—For palliative treatment the urinary antisep-tics, Salol and Urotropin, are frequently used.

Eichhorst advises, first, the use of an antiseptic, as Salol, for ten days to two weeks; then Turpentine, and finally Tannic acid. He uses the above as follows:

Salol, fifteen grains; Saccharin, one-third of a grain; ten powders, one every two hours. Oil of Turpentine, dose, ten drops in milk three times daily. Tannic acid, four and a half grains; Saccharin, one-third of a grain; ten capsules, one every three hours.

The writer frequently uses Urotropin instead of Salol, and occasionally Eucalyptol instead of Turpentine.

*Urotropin* is valuable in chronic cases, especially in the elderly, when there is weakness, loss of appetite, pale color, dry, crusted tongue, thirst, and slight rise of temperature, as

in cases of chronic urinary fever due to absorption of micro-organic toxins or of urinary poisons. Dose, from three to seven and a half grains, taken first twice, later three times, daily in a glass of water. Increased if necessary to ten grains three times daily.

The writer finds Urotropin fairly reliable. Sometimes, when the urine is scanty, it may with advantage be alternated with the corn-silk and lithia mixture mentioned before. Simple catarrhal pyelitis often subsides by treatment with this agent (Urotropin) and rest in bed.

*Salol* is used for much the same purpose as Urotropin. It may be given in eight-grain doses, three to five times daily.

*Ergot* is advised by Morris in doses of one-half drachm of the fluid extract when polyuria is a feature.

*Creasote* is recommended by Dickinson in cases where the urine is foetid.

*Potassium citrate* is suggested by Osler, who thinks that astringents are useless in pyelitis.

*Hydrangea* is useful in calculous pyelitis due to uric acid, especially when combined with lithia, and the same may be said of *Corn-silk*. The writer uses a lithiated sorghum compound (corn-silk, broom-tops, lithia) with marked palliative effect in these cases.

Chronic cases may require Salol, Urotropin, Sandalwood, Juniper, Copiva and Erigeron as palliatives.

**Symptomatic Treatment.**—**Acute Pyelitis** :—The principal remedies are Aconite, Bryonia, Belladonna, Cantharides, Chimaphila, Cannabis sativa, Rhus tox., Terebinthina, Uva ursi.

**Chronic Pyelitis** :—The principal remedies are Benzoic acid, Berberis vulg., Buchu, Cantharis, Chimaphila, Hydrastis or Hydrastinum, Pareira brava, Pulsatilla, Sepia, Sulphur, Stigmata maidis, Uva ursi.

*Cantharis*, not lower than the third, is the remedy when micturition is painful and the urine contains pus and blood. Useful in either acute or chronic pyelitis.

*Uva ursi* is best adapted to acute pyelitis, and is best given, according to Hughes, in form of a trituration of the leaves. A tea made of the leaves, one tablespoonful to a large glass of hot water, given three or four times daily.

*Corn-silk*.—Useful when the urine is scanty and acid. Combined with lithia is serviceable for increasing the urine and dissolving sediments of uric acid if present.

*Terebinthina* for violent burning, tearing pain in the renal region, pronounced strangury, scanty, bloody urine, frequent micturition at night.

If the urine is strongly acid, give also alkaline demulcent drinks.

Drop doses of the oil may be given; in some cases two to five minims may be necessary; or *Eucalyptol* in capsules in the same dose.

*Mercurius* is said to be indicated especially when the amount of pus in the urine is very large. (Use third decimal.)

*Copaiba* is indicated by pain in the renal region, tenesmus, and haematuria with albuminuria.

*Arsenicum* in the 3x trituration for the cachexia caused by long-lasting suppuration. Haematuria with burning pain, albuminuria with weakness, emaciation and oedema, colliquative diarrhoea and hectic fever are *Arsenicum* symptoms.

*China* is recommended by Hughes in chronic suppurative pyelitis.

*Silica* is recommended by Jousset in high dilutions as of value in suppuration.

*Chimaphila* (in ten-drop doses of a good fluid extract) diminished the pus sediment in one of the writer's cases of simple pyelitis of not long standing.

*Sulphate of quinine* is recommended (in doses of from fifteen to twenty-two grains) for the pernicious attacks during the acute period of pyelitis. It should be administered during the decline of the attack.

**Chronic Pyelitis.**—The remedies are as follows (in addition to those already mentioned):

*Barosma*.—Recommended by Dr. E. M. Hale in chronic pyelitis.

*Benzoic acid*.—After the pain and fever of the acute stage have subsided, but urine is still cloudy, scanty, of dark-brown color, and strong urinous (*not ammoniacal*) odor.

*Berberis*.—Useful in the pains of chronic pyelitis. Suppuration on the left side, very severe pain from left kidney down ureter to hip. *Berberis vulgaris*, first decimal dilution. Berberis is a remedy which is especially suited to disorders of the lumbar region.

**Special Therapeutic Measures.**—In this disease, as in all others where pus formation occurs, administer protonuclein, one tablet every two hours, to repair the waste.

Applications of antiphlogistine to the renal region should not be forgotten.

In recent cases of moderate intensity Buchu, Arbutin and Gallic acid will sometimes reduce the amount of pus.

In older cases, where there is much pus, Boracic acid in two to ten grain doses, largely diluted with water, often acts efficiently.

In cases which have been aggravated by sexual excesses Damiana is said to be useful.

Wet cups followed by warm poultices and leeching are advised by some writers when there is severe pain.

Ox-gall with Nux and Pancreatin may be needed when there are digestive disturbances.

In chronic cases change of air, especially from the interior to the sea, is recommended.

For the gouty patient the imported Vichy water and the various alkalies are useful; for the oxaluric patient Contrexéville water, and either Nitro-muriatic acid or Lysidin. (See **OXALURIA**.)

**Surgical Treatment.**—Since pyelitis is sometimes due to

obstinate urethral stricture, the latter must be relieved, so that the urine may flow freely.

In cases of calculous pyelitis it is necessary to remove the stone by operative measures. Tumors in operable cases should also receive attention.

To prevent ascending pyelitis when an operation is performed on the lower genito-urinary organs careful aseptic measures, extreme gentleness, free bladders, drainage and internal use of Salol or Urotropin are advised.

In tubercular cases, if acute and primary, nephrectomy must be performed.

Acute ascending pyelitis sometimes requires nephrectomy.

According to Carleton, in chronic pyelitis due to obstruction to the free flow of urine, drainage of the bladder by perineal section is frequently of great benefit; otherwise surgical relief will be required only in tubercular or lithæmic cases.

Kelly treats pyelitis in women by ureteral douching of the pelvis of the kidneys with Boric acid, Silver nitrate, or Mercuric chlorid solution. Adams has used the same treatment successfully in tubercular pyelitis in women.

After introducing the ureteral catheter suction is used by means of a syringe to draw down thick pus, small stones or other obstructive material, following which the douche is made.

#### TUBERCULOSIS OF THE PELVIS.

This, as already described, may be miliary or caseous, the latter more common and always secondary, the former rare and apparently haemogenous.

The mucous membrane in chronic caseous tuberculosis is infiltrated and thickened; caseation takes place, leading to ulceration.

The ureter is involved first, either above or below, its wall thickened, its lumen reduced and sometimes obliterated; or the disease may take the form of an ulcer.

## TUMORS OF THE PELVIS AND URETER.

*Villous papilloma* is comparatively frequent; rarely, malignant papillomatous neoplasms occur.

*Carcinoma* of the pelvis may be associated with calculi.

*Lympho-sarcoma* occurs in the pelvis.

A tumor resembling *adenoma* has been found in the ureter, perhaps springing from rests of the Wolffian duct.

Rarely, *primary sarcoma* has been found in the ureter.

## CYSTS OF THE PELVIS AND URETER.

Multiple small cysts have been found in the pelvis, calices, bladder, ureter and urethra. Their origin is in doubt.

## PARASITES OF THE PELVIS.

These are *Distoma hæmatobium*, the *Filaria sanguinis hominis* and the *Eustrongylus gigas*. The eggs of distoma occur in the urine in large numbers, appearing in small pointed bodies 0.12 mm. long and 0.04 mm. wide. They are oval and in the neighborhood of one pole there is a lateral process.

*Filaria* causes hæmaturia and chyluria.

*Strongylus gigas*, the palisade worm, is rarely found; when present it causes pyelitis and vesical tenesmus, with pyuria and hæmaturia.

The parasite shows six nipple-like papillæ around the buccal orifice.

These parasites are common in Egypt.

## RENAL CALCULUS.

**Synonyms.**—Nephrolithiasis. Stone in the kidney.

**Definition.**—The conditions associated with the formation of precipitates from the urine in the kidney or renal pelvis.

**Occurrence.**—In men rather than in women; most frequently in children and elderly people. It occurs usually before the age of fifteen and after fifty. It is more common in those who lead a sedentary life. Soldiers and sailors are free from it. Locality appears to favor it, as it is common in England and in Holland. Some persons cannot drink white wine without immediate formation of renal calculus. (Eichhorst.)

**Etiology.**—The causes are as follows :

1. Heredity.
2. Locality.
3. Sedentary and luxurious habits.
4. Gout.
5. Cystinuria.

Renal calculus is frequently the result of the inheritance of various anomalies of metabolism as shown by lithæmia, oxaluria, cystinuria, etc.

Bacteria play a part in the formation since all conditions of urinary stasis are favorable to the formation of calculus.

**Cause of Formation.**—Clots, shreds of tissue, and ova of parasites may serve as nuclei, but immediate cause of formation is not always understood. The nucleus is usually organic.

**Varieties.**—The most common are :

1. Uric acid and urates.
2. Calcium oxalate.
3. Phosphates.

Rarer are calcium carbonate, cystin, xanthin, and indigo.

**Size, Number and Form.**—Calculi occur in one or both kidneys, are single or many, and vary in size from that of a grape-stone to that of a goose egg. They may be round or smooth, granulated or spinous, or irregularly branching, like antlers with protuberant knobs projecting into dilated calices. A Y-shaped stone blocking the ureter occurs.

**Properties of Calculi.**—Calculi are found in acid urine, except phosphatic stones, which occur in alkaline. Uric acid are yellow, red or brown, lamellated when broken. Calcium oxalate (oxalate of lime) are dark-brown and dense.

Phosphatic calculi are gray, somewhat porous, and easily broken.

Cystin calculus is of a waxy character.

Xanthin forms a hard brown stone.

Indigo a dense blue mass.

The urate and oxalate are most common. When there is ammoniacal decomposition of urine in the pelvis, the phosphatic calculi may be deposited in which case the urine will contain a large amount of crystals of triple phosphate, which at first are unaccompanied by pus.

A urate or oxalate stone may be coated with phosphatic deposit, in case the urine becomes ammoniacal in the pelvis.

The so-called *coral-stones* are composed of uric acid and urates. They may form moulds of the renal pelvis.

*Fibrinous concretions* sometimes occur, the result of antecedent haemorrhage, and are of tough, flexible and extensile structure; inflammable, burning with the odor of burnt feathers.

Renal calculus, if in a calyx of the kidney, may have the shape of a pastel. Hundreds of them are sometimes found in the renal pelvis.

Nephro-lithiasis may show itself by the passage of either sand, gravel or calculus. The term *sand* is applied to fine pulverulent material, *gravel* to particles of coarse grain and those which are the size of a pea.

**Diagnosis.**—If a patient states that he has at one time passed gravel or sand in his urine, and if there is considerable sediment in his urine, dull pain, frequently retraction of the testicle, the dull pain is increased by deep palpation or by jolting, while seated in a vehicle, over rough roads, car tracks, etc.—especially if he has passed blood in his urine after such a trip—then the presence of stone is almost certain.

Confirmatory of the above is a history of renal colic. (See CLINICAL FEATURES.)

**Diagnosis by Catheterization of the Ureters.**—Catheteriza-

tion of the ureters with a wax-tipped catheter is the most direct means, says Kelly (*Journal of Obstetrics*, October, 1901), of ascertaining the presence of calculus in the urinary tract. The success of the method depends upon care and skill on the part of the examiner, together with attention to detail in preparing the instrument. The presence of the scratch-marks is the most important feature in diagnosis of



FIG. 23.—Calculus pyelitis.—(RAYER.)

calculus by this means, but the method affords valuable confirmatory evidence in other ways. In ureteral calculus the method by dilating the ureter and thus inducing the escape of the stone through the natural channel may obviate the necessity for operation. If all precautions have been taken, the presence of scratch-marks is positive evidence of the existence of calculus; but the absence of scratch-marks cannot be

accepted as proof that no stone exists. The possible presence of a double ureter, with two openings into the bladder, should always be borne in mind.

**Clinical Features.**—If the stone is smooth and embedded in the renal parenchyma, no symptoms or inconvenience. Usually, however, the symptoms are as follows:

1. *Lumbar Pain.*—A dull, boring ache, either fixed or radiating toward the genitals or upper portion of the thigh of affected side. The pain may be referred to the sound kidney.

2. Irritability of the bladder.

3. *The posture and gait* of the patient are affected. He walks with the body bent forward, with the shoulders depressed toward the affected side, with the vertebral column convex toward the healthy side, avoiding rotation and flexor movement of the vertebrae. In walking he is as stiff as a stick and places his feet with care gently on the floor especially the foot on the diseased side. (Eichhorst.)

4. There may be reflex nausea and vomiting for weeks or months early in the case.

5. Chills and fever in case pyelitis is caused.

6. *Renal colic.*—Due to passage of the stone through or into the ureter, with symptoms as follows: pain beginning instantaneously, even when the patient is asleep; more commonly after exertion. The pain is cutting, stabbing, sharply defined along the course of the ureter, either toward the genitals or into the thigh.

It may be most severe in the back or radiate upwards into the epigastrium. The pain may cease as suddenly as it came, if the stone slip back into the renal pelvis or pass into the bladder. Recurrence of paroxysm may take place, if stone again endeavors to pass from pelvis into or through the ureter.

After the attack there is a period of prostration, and aching pain may persist in the region of the affected kidney for a considerable time after the stone has passed.

**Conditions Associated with Renal Colic.**—Chilliness, chills,

faintness, nausea, vomiting; increased frequency of micturition, and haematuria. The latter may be present several days after passage of the stone. The quantity of urine is generally less than normal, but, after the attack, polyuria is common. In rare cases there may be total suppression of urine, even though the stone is impacted in but one ureter.

Death may result from anuria, whether due to shock of the intense pain or not is not known. Total anuria may persist from three to eleven days.

*Impaction of the stone* in the ureter may lead to ulceration, perforation, abscess and peritonitis.

**Position of the Patient During the Attack.**—Usually on the affected side, with up-drawn knees. Testicle of affected side is frequently retracted, or even swollen, if pain extends to the scrotum.

**Length of Time of Attack.**—The spasm may last for an hour or more, or recurrent paroxysms may continue for many hours, with sudden relief, if stone enters the bladder.

**The Urine.**—1. Persistent presence of blood-corpuscles in the sediment is a feature. At times, especially after exertion, blood visible to the naked eye.

2. Features of pyelitis; pus in small quantity in acid urine; or chronic catarrh of the urinary passages.

3. Passage of gravel.

4. The writer with the aid of the centrifuge nearly always finds casts, hyaline or finely granular or yellow granular. They are probably dependent on the hyperæmia incited within the pelvis of the kidney.

5. It is said that in some cases of unilateral renal calculus the urine is normal, and that in other cases evidences of renal disease, not calculous, appear.

During *renal colic* there may be strangury, and it frequently happens that suppression and even uræmia supervene, although the opposite kidney be perfectly normal. Some patients on the other hand during an attack void large quantities of clear urine.

## ANALYSES OF THE URINE IN RENAL CALCULUS.

In the case of a man from whose kidney Dr. Charles Adams removed a large stone, the following analyses of the urine were made by the writer prior to the operation:

	<i>First Analysis.</i>	<i>Second Analysis.</i>
Volume per 24 hours, . . . . .	725 c.c. (24 fl. oz.)	1400 c.c. (47 fl. oz.)
Ratio of day urine to night, . . . .	0.7 to 1.	0.4 to 1.
Urea total, . . . . .	18.5 gms. (285 grs.)	18 gms. (280 grs.)
Phosphoric acid, . . . . .	1.3 gms. (20 grs.)	1.47 gms. (22 grs.)
Uric acid, . . . . .		0.7 gms. (11 grs.)
Urea to phos. acid. . . . .	13 to 1.	14 to 1.
Urea to uric acid, . . . . .		26 to 1.
Specific gravity, . . . . .	1.019.	1012.
Total solids, . . . . .	30 gths.	34 gms.
Albumin, . . . . .	(Esbach) 0.05 %.	0.0016 %.
Pus sediment, . . . . .	Abundant.	Abundant.
Crystals, . . . . .	None.	None.
Casts, . . . . .	A few granular.	None.
Epithelia, . . . . .	Renal.	Renal and bladder.

These analyses show the following:

1. Stone in the kidney is not necessarily accompanied by excess of solids in the urine.
2. Total urea and total phosphoric acid may be deficient in the urine of a patient having stone in the kidney.
3. With deficiency as above of urea and phosphoric acid, uric acid may, however, be in considerable *relative excess*.
4. Crystals may be at times entirely absent from the urine.
5. Casts may be found at times.

In several other cases confirmed by operation the writer has found casts.

**Situation of the Calculus.**—If the calculus be in the *substance of the kidney*, and there is no pyelitis, pain slight, or severe for a time and then disappearing for years. Sometimes constant dull pain in the loin. No general disturbance.

*If the calculus be free and moving in some large cavity of the kidney or in renal pelvis, the pain is felt not only in the*

loin, but along the course of the ureter, and even as far as to testicle, inner aspect of thigh, or lower part of leg, even in the heel. Pain much worse on motion.

*If the calculus be dislodged from the infundibula or from fixed position in renal pelvis, pain, then severe and paroxysmal nausea, faintness, vomiting.*



FIG. 24.—Radiograph of oxalate stone in substance of the kidney.—(From FRNWICK.)

*If the calculus be in the ureter, then renal colic, agonizing pain, nausea, faintness, writhings and contortions, even convulsions. After some hours, pain subsides suddenly. There may be sudden suppression of urine on one side; urine reduced suddenly to half the normal quantity.*

*If the calculus be impacted in the ureter, pain sets in suddenly and is only gradually relieved; does not cease suddenly, but there are paroxysms of pain, until finally the ureter becomes habituated to the presence of the stone.*

If the calculus be impacted in the ureter close to vesical exit, site of pain, after having for some time shifted in a direction generally downward, suddenly becomes *fixed*; there is evidence of suppression of urine on one side.

*If the calculus has become merely displaced from renal orifice of ureter*, but is not yet in bladder, another paroxysm of pain may take place at any time.

*If calculus has passed into bladder*, patient may possibly be aware of it. The renal colic ceases and after a time signs of the presence of the stone show themselves as follows: Hæmaturia after strong bodily exertion, disappearing after a long rest; day urine contains more blood than night; the urine begins to show the features of cystitis. (See CYSTITIS.) Sounding for stone will sometimes reveal its presence.

*Both kidneys affected or one only?* If the stone is primarily phosphatic the disorder is limited to one kidney.

If the stone is uric acid or oxalate, both kidneys may be affected.

If during renal colic, while one ureter is blocked, the urine voided be perfectly normal, then the one kidney is healthy.

In doubtful cases try compression of ureters or catheterization.

It must be remembered that absence of the symptoms mentioned above does not necessarily signify absence of calculus. In some cases the diagnosis cannot be made with certainty. The urine is often normal in all respects and gives no sign of the presence or character of the calculus. Renal colic may be the first marked symptom. Moreover, the symptoms of calculus, viz., lumbar pain, extending at times to the groin and testicle, paroxysmal, aggravated by movements, accompanied or followed by hæmaturia, pyuria, and frequent micturition, may all be present, and yet there be neither stone in the kidney nor disease of the bladder. (See TUBERCULOSIS OF KIDNEY.)

The writer's paper in Dr. Aldrich's *Minneapolis Journal* was as follows:

## TYPICAL CASES.

Typical cases of renal calculus may usually be recognized without much difficulty by paying attention to the history and clinical features of the case. The patient is either a child or more commonly a middle-aged male adult, with previous history either of good general health or of the uric acid diathesis, who lives or has lived in a limestone district, especially where the hard water of artesian wells is used. His habits are usually, though not invariably, sedentary or luxurious, and he is likely to be a hearty meat eater, or a beer or wine drinker. In most cases he begins his illness by feeling a dull pain in the loin, which is aggravated by riding, especially over a rough road. Sometimes there is marked sensitiveness to pressure over the region of the affected kidney, and the patient flinches from the touch of the physician's thumb or finger. In some cases there is no sensitiveness over either kidney, even on deep pressure. In one such case seen by the writer the patient insisted that the pain was affected by the weather, being worse in damp weather.

Sooner or later renal colic takes place, quite often after violent sudden exertion, jolt or fall. In one case observed by the writer it came on when the patient tried to lift a trunk. Sometimes, however, renal colic appears after but slight exertion, and occasionally it may occur even when the patient is quiet in bed.

Renal colic begins suddenly; the pain is cutting, stabbing, sharply defined, follows the course of the ureter towards the genitals, or into the thigh. The testicle on the affected side is frequently retracted; there may be chills or chilliness, elevation of temperature, faintness, nausea and vomiting. The pains may be in some cases more severe in the back or radiate upward into the epigastrium. After an hour or so the severe pain may cease as suddenly as it came on, after

which there is more or less prostration, and an aching pain in the region of the affected kidney, persisting for a considerable time.

Whether the patient has renal colic or not, the condition of the urine is important. Persistent presence of blood corpuscles, or of blood, visible to the naked eye, is a common feature, while at the same time the symptoms and history of other maladies, as renal congestion, genito-urinary tuberculosis, bladder, prostatic or urethral lesions, by which the presence of blood can be accounted for, are absent. Blood in the urine, more abundant after exercise, together with pain in the loin, should always arouse the suspicion that calculus is present in the kidney. Especially is this suspicion warranted, if the haemorrhage does not occur immediately after the exercise or exertion in question, but follows after some hours, or even on the next day ; for example, a man rides around his farm on Monday, and on Tuesday has a urinary haemorrhage.

Next of importance, though not of frequent occurrence, is the presence of sharp, spiny, reddish crystals of uric acid in the urine, easily seen by the microscope with a low power, say, 150 diameters. These signify hyper-acid urine and deposit of crystals in the uriniferous tubules, and also in the calices and pelvis.

Sharp-pointed crystals of uric acid without blood may be found in the urine in cases of rheumatism ; sometimes together with blood in renal tumors. As a rule, however, blood and sharp uric acid crystals signify calculous pyelitis. Quite commonly any crystals of uric acid may have sharply defined edges, but unless they taper to a sharp point they are not to be regarded as significant. Crystals of urate of ammonium in stale or decomposed urine have small spiny projections, but the latter can be seen plainly only with a high power, say, 500 diameters. When the ureters can be catheterized, excess of any crystals found in the urine of one side over that from the other is an important aid in diagnosis.

In cases of renal calculus, when blood is found in the urine, it is almost always more abundant in the day urine than in the night, whereas in tumor or in tuberculosis, haemorrhages at night are not unusual.

Next in importance is the occurrence of pus in the urine, with or without blood or crystals. In cases in which there is much sensitiveness to pressure over the affected kidney, together with pus in acid urine, it should arouse the suspicion that calculus is present, even if blood and crystals can not be found in one or two examinations. If the urine is watched carefully and examined repeatedly, blood corpuscles will in all probability eventually be found by the microscope, if renal calculus is present.

Again, it seldom happens in cases of renal calculus that tube-casts are absent from the urine. They are usually of the hyaline variety, with renal epithelium scattered about in them, the latter being stained yellow by the coloring matter of the blood; sometimes we find, also, yellow granular casts. As a rule, casts, when present, are not abundant, five or ten in all in the sediment of half a fluidounce of urine. When much pus is present in the field, tube-casts may escape notice.

Lastly, it is not unusual to find a low ratio of urea to uric acid; less than forty parts of urea to one of uric acid, when the patient has not yet been put on a diet.

The diagnosis may be confirmed by the X-ray, especially in thin patients and where the calculus is large, but a stone in a fat person may not be detected by this means.

#### ATYPICAL CASES.

Cases occur in which the stone is too large to pass through the ureter into the bladder, so that a typical renal colic, beginning suddenly and ending suddenly, is not observed. In such cases there are recurrent attacks of back-ache, chill, fever and high colored urine. If the calculus be dislodged from the infundibula or from fixed position in the

renal pelvis, then there may be observed the usual symptoms of renal colic, viz., severe paroxysmal pain, nausea, vomiting, faintness, etc., lasting until, for any reason, the stone slips back out of contact with the ureter into the pelvis of the kidney again, which it may not do for hours. The pain, in such cases, recurs from time to time, according to circumstances. If the calculus becomes impacted in the ureter, the pain sets in suddenly and is only gradually relieved, the paroxysms recurring until the ureter becomes habituated to the presence of the stone. Cases occur in which the stone becomes impacted in the ureter, close to the vesical orifice, in which case the site of the pain, after having for some time shifted in a direction generally downward, suddenly becomes fixed and the quantity of urine may be diminished materially, owing to suppression on the affected side.

Cases also occur like the one mentioned at the beginning of the article, in which backache and obscure nervous symptoms are the only clinical features, the urine being normal in all respects. The first marked symptom in this class of cases may be renal colic.

On the other hand, renal colic may be experienced and stone be absent altogether, the pain being due to the passage of tuberculous material, or hydatid sacs, or simulated by kinking of the ureter or spasm of the ureter.

#### DIFFERENTIAL DIAGNOSIS.

The differential diagnosis of renal calculus from other maladies is of the utmost importance, because of the bearing on treatment. Cases frequently occur, to the surprise of all concerned, in which operation for calculus fails to find any stone at all.

The diseases which may simulate renal calculus are as follows:

1. Most commonly, renal tuberculosis (primary).
2. Movable kidney with kinking of the ureter (Dietl's crises).

3. Chronic interstitial nephritis with adhesions.
4. Inflammation and dilatation of the renal pelvis from causes other than stone.
5. Reflex spasm of the ureters or of the right ureter alone.
6. Nephritis with backache and conditions of tension.
7. Paranephric abscess.
8. Various colics; appendicular, hepatic, gastric, intestinal, and that of lead poisoning.
9. Malaria.
10. Stone in the bladder.
11. Dysmenorrhea.
12. Spinal caries.
13. Locomotor-ataxia.
14. Renal hydatids.
15. Malignant growths.

In primary renal tuberculosis we find the patient under forty years of age; commonly a puny, pale, lightweight, anaemic male, between twenty and forty, with cold hands and clubbed finger nails. The finger in the rectum may discover nodules in the prostate and seminal vesicles. He has increased frequency of urination, both at night and by day, while the patient with renal calculus has frequency chiefly during attacks of renal colic. The tuberculous patient may pass blood freely during the night, while the patient with calculus seldom voids blood at all during the night, or if he does, it is in small quantity, compared with the day.

The tuberculous patient is likely to have more or less pyrexia and symptoms referable to the bladder, which are not characteristic of renal calculus. Discovery of the bacillus of tuberculosis is an aid in diagnosis, as is also the presence of caseous masses in the urine. The patient with renal tuberculosis never feels well, but the patient with renal calculus often feels entirely well between attacks.

*Moveable kidney* with kinking of the ureter may give rise to attacks simulating renal colic. The attacks (Dietl's crises)

of abdominal pain are severe, with chills, fever, nausea, vomiting and prostration. The urine during the attack is scanty, contains an abundance of urates and oxalate crystals, and both blood and albumin may be present. During the attack a swelling may be perceived, due to hydronephrosis, which subsequently disappears when the attack is over, and a copious flow of clear urine takes place. If, as is not rarely the case, the movable kidney is nephritic, albumin and casts will be found in the clear urine voided after the attack. Rarely, movable kidney without kinking of the ureter, is accompanied by hematuria, probably from congestion, as suggested by A. T. Cabot.

In movable kidney the patient is usually a thin person, especially a thin woman, who has borne children in rapid succession and who has a history of a complexus of symptoms, mental, neurasthenic, gastro-intestinal, hepatic, uterine and ovarian. After the crisis of pain is over, it is often not difficult to perceive, by palpation, a movable tumor in the loin, manipulation of which may cause peculiar sinking, fainting sensations. Cases may now and then occur in stout persons, and the differential diagnosis from stone dislodged, but not passed, is then difficult. In such cases persistent examination of the urine must be made for the more or less continuous presence of blood corpuscles and casts of the hyaline or yellow granular form, as significant rather of calculus than of nephroptosis. But if in a stout person, a movable kidney happens to be also nephritic, it may be impossible to differentiate definitely without long observation of the case, unless the urinary features of renal calculus above described become marked. In cases where, between attacks of pain, the urine is normal, the chances are in favor of movable kidney rather than calculus.

*In chronic interstitial nephritis*, with density of structure of the kidney, it sometimes happens that there are adhesions to the surrounding parts and retractions under the ribs, evoking

attacks of fixed renal pain, accompanied by frequency and difficulty of micturition. In such cases we have the cardiovascular symptoms of contracting kidney, the absence of blood and crystals from the urine, except in haemorrhagic cases, and the characteristic urine of contracted kidney, namely, of low specific gravity, poor in solids and especially in uric acid. In these cases it is said that nephropexy relieves the attacks of pain.

*An inflamed and dilated renal pelvis*, without presence of stone, may cause attacks of pain simulating renal colic. Cases have occurred in which operations for stone have been performed, and although no stone was found, recovery has taken place afterwards. In stout patients differentiation from calculus is difficult, but in thin persons the X-ray is of value in the diagnosis. The history of the case becomes important in making the diagnosis; anything which points to the passage of an irritant, bacterial or toxic, though the kidneys, or especially infection from operations on the lower urinary tract, being in favor of non-calculous pyelitis. The general condition of the patient in most cases of renal calculus is good, and the history often that of freedom from previous illness.

*Spasm of the ureter*, occurring in women, may be mistaken for renal colic. This is usually a sequence of urethritis. The patients describe the spasms as occurring most often during the night; they awake with a pressing desire to urinate; the emptying of the bladder is accompanied by more or less pain and spasm, and followed by a cramp-like pain, ascending along the course of the ureter to the kidney, and also radiating to the lower extremity. The diagnosis of urethral lesion is of aid in differentiating this spasm from renal colic; or else the history of some previous disease in the lower urinary tract shows the reflex nature of the spasm. Absence of stone shown by the X-ray in thin persons, or of blood, pus, or excess of crystals, shown by ureteral catheterization, will help to exclude renal calculus.

In either sex, spasm of the right ureter alone may occur and be reflex and sympathetic, due to disease in the gall-bladder, appendix or colon. Examination of the urine, however, shows no evidences of renal calculus in such cases, and the latter may be excluded, as above, by the X-ray or by ureteral catheterization.

The backache occurring in nephritis is usually readily recognized as such by the presence of a comparatively large amount of albumin in the urine, and of numerous and various casts. If, in addition, pallor, weakness, dyspnoea and oedema are found, the diagnosis of nephritis becomes more certain.

*Conditions of tension* of the capsule of the kidney not infrequently simulate stone, as in cases of acute hyperæmia and in hypertrophy of the organ. If operation for stone is performed and the search for the latter made by splitting the kidney along the convex border, the tension is relieved and the symptoms cease after operation.

*In paranephric abscess* the pain may be severe, and the renal congestion such that blood-corpuscles are found in the scanty, high-colored urine. The course of the disease is such, however, as to enable us usually to differentiate without difficulty. The history is also of service, as this disorder is the result of extension of an inflammatory process from elsewhere, as from appendicitis, pelvic cellulitis, and various suppurative lesions. It also occurs from a wound or surgical operation, and as a sequence of infectious diseases.

In paranephric abscess we eventually find a painful tumor in the region of the kidneys, with chills, fever, etc. In renal calculus we have usually a history of good previous health, or at least of an absence of suppurative or infectious disease, and tumor is absent except in cases where impaction leads to hydronephrosis or pyonephrosis, neither of them so sensitive to pressure nor so extremely painful as the paranephric abscess.

*Appendicitis* is a disease which, when not typical, must be differentiated from renal calculus. Ordinarily, renal colic is

distinguished by the absence of tumor, fever and spot of tenderness, but atypical cases of appendicitis may be mistaken for renal colic, especially when there is no tumor, no marked temperature, and when the pain is in the right hypochondriac region. If there is localized extreme tenderness in the right lower abdomen, appendicitis is the cause, but when the point of greatest pain is in the right hypochondriac region, care must be observed to determine whether or not it is "the spot of tenderness" of appendicitis in an unusual location, or whether it is simply the locality where the pain is the worst. The general tendency in appendicitis for the pain to settle rapidly into the appendicular region is a help in differentiating. Moreover, the character of the pain in the two diseases is likely to be different. In renal colic it is the writer's experience to find in the intervals between the severest attacks a tendency on part of the patient to brace his feet, if he can, against something; whereas, in appendicitis the general tendency is to draw up the leg on the affected side.

It must not be forgotten that the urine in appendicitis is scanty, and that micturition may be frequent, as in renal colic. Moreover, retention of urine later in the case is noticed in appendicitis, which may be mistaken for the suppression of urine, which is sometimes noticed in renal calculus. If we find in the urine blood-corpuscles, casts and crystals, especially sharp uric acid crystals, while at the same time it can be decided that a spot of extreme tenderness is absent, even though we can find the locality of greatest pain, the chances favor renal calculus, especially in the absence of tumor and temperature, and especially if the pain does not settle into the appendical region. Leucocytosis being absent is also in favor of renal calculus. It must not be forgotten, however, that a patient with slight calculous pyelitis may be seized with acute atypical appendicitis, in which case the determination of a spot of real tenderness and the presence of leucocytosis are of importance. Some clinicians dwell on the

fact that in renal calculus the pain may radiate into the groin and testicle, but this may also be true of the pain of appendicitis, at least after it has settled into the appendicular region.

*Hepatic colic* may be mistaken for renal colic before the occurrence of jaundice, and when there is no bile in the urine. Cases are commoner in women than in men. The pain of gall-stone colic is usually preceded by a feeling of intense fullness in the region of the liver, coming on several hours after meals. The pain is located over the liver, over the gall-bladder, toward the umbilicus, toward the right shoulder, sometimes toward the epigastrium. Tenderness on pressure is present and remains after the pain ceases. Jaundice, together with biliary matter in the stools and urine, favors the diagnosis of hepatic colic. An inflamed and distended gall-bladder presents pain, tenderness, tumor and fever. The tumor is pear-shaped, movable, and is rather above than below the level of the navel, and is more likely to be confounded with renal tumors than with renal calculus.

The tendency of renal colic to make the testicle tender and retracted is of service in differentiating renal calculus from both hepatic and intestinal colic, as is also the condition of the urine.

*Intestinal colic* is not so sharply defined as renal colic, and lacks the retraction of the testicles and the urinary features of renal calculus. Both intestinal and gastric colic tend to improve rapidly.

*The colic of lead poisoning* may be inferred from the history, the presence of a blue line around the gums, paralysis of the extensors, and obstinate constipation. The urinary features are either lacking or are those of contracted kidney.

Singularly enough, renal calculus has been mistaken for *malaria*. In some cases, when the stone is too large to be voided by the ureter, recurrent attacks of non-suppurative pyelitis may occur, and the backache, chill, fever and high-colored urine closely simulate malarial attacks. Presence of

blood-corpuscles, microscopically, and of sharp, spiny crystals of uric acid, together with the absence of the plasmodium from the blood, tends to show presence of renal calculus, especially when the climate and the history do not support the diagnosis of malaria.

*Stone in the bladder* is sometimes mistaken for stone in the kidney. More commonly stone in the kidney is mistaken for stone in the bladder, especially when phosphatic calculus is present. But when the renal stone is phosphatic, in such cases as have occurred in the writer's experience, the urine contains a large quantity of triple phosphate crystals with neither sticky pus and blood, nor the micro-organisms that we find in vesical calculus. If, at the same time, the classical symptoms of bladder-stone are absent, namely, frequent and painful urination, together with stoppage of the stream, with a twinge of pain shooting along the course of the urethra to the meatus, the presumption is in favor of the presence of renal rather than vesical calculus. Moreover, it will be remembered that the pain and frequency in cases of vesical stone are worse on motion and aggravated, therefore, by walking, not so much by riding in a carriage or other vehicle. The X-ray should, in many cases, be of service in detecting stone in the bladder, to say nothing of what is found by use of the sound; the history of residual urine, or the prior occurrence of renal colic, will aid us in distinguishing vesical stone. In cases of stone in the bladder, the urine may be very strongly ammoniacal, and the pain on urinating extreme, which is not common in cases of renal calculus.

*Dysmenorrhœa* should not be confounded with renal calculus, if attention is paid to the comparative regularity in the periodicity, and to the absence, between attacks, of blood-corpuscles from the urine. Moreover, the connection of the pain with the menstrual flow should be evident.

*Spinal caries* is sometimes distinguished with great difficulty from renal calculus. An abscess in connection with spinal

caries may open into the pelvis of the kidney, and pus be found in the urine. Absence of abnormal constituents of the urine prior to the sudden appearance of a considerable quantity of pus will aid in differentiating.

The pain in renal crises of *locomotor ataxia* should be easily differentiated from that of renal calculus by the associated presence of Argyll-Robertson pupil, the loss of knee-jerk and the disturbances of co-ordination. It must not be forgotten that cystitis is frequently observed in locomotor ataxia, hence the presence of pus and triple phosphate crystals should not lead us to infer that renal calculus is necessarily present.

*Renal hydatids* may give rise to renal colic from passage of the hydatid sacs through the ureters. In this case there is further trouble in expelling the vesicles through the urethra. Retention of urine takes place, with excessively frequent desire to pass water, and there is severe pain extending to the end of the penis. When once the vesicles are expelled, which may require considerable force, relief follows. The diagnosis of hydatids presents no difficulty when there is a tumor in the loin and when the vesicles are found in the urine. When, however, vesicles are absent from the urine, the tumor may be mistaken for hydronephrosis and in turn it may be assumed that the latter is due to impacted calculus. In such a case, unless the history is of service, as, for example, that of use of uncooked meats and salads in places where dogs are numerous and live in close association with their masters, the diagnosis is practically impossible.

*Malignant growths* have been mistaken for renal calculus. Owen describes at length a case in which the symptoms described by the patient and his attending physician were significant of renal calculus—gravel seventeen years before, frequent micturition, pain in thigh and testis, haematuria, and rigidity of the muscles over the left kidney. The kidney was explored and found to be perfectly healthy. The patient died three days after the operation, apparently of exhaustion. The

autopsy showed an epithelioma of the descending colon with metastatic nodules in the liver. Ureteral catheterization and the Roentgen ray might have been of service in this case. (Adams.)

Whether the stone is in the right kidney or the left is a matter which can not be settled in all cases without the use of the X-ray.

Owen cites a case in which the patient had experienced dull pains in the back ten years previous to admission. About five years before he had a severe attack of renal colic on the left side and had passed blood and small calculi on several occasions. For the two years previous to admission, however, the pain had been on the right side, and the patient was firm in the belief that the small calculi passed from time to time had come from the right kidney. An exploratory operation on the right side showed the right kidney to be larger than normal, but otherwise healthy. About a month later the left kidney was opened and a calculus found. (Adams.)

**Associated Conditions.**—Commonly, dilatation of renal pelvis, which is often extreme, and pyelitis; abscess of the kidney or paranephritis may result from the pyelitis, the latter shown by increase in size of renal tumor and persistent elevation of temperature. Chronic interstitial nephritis may also result with mild uræmia, or amyloid disease with prolonged cachexia.

There may be renal-pelvic fistula, ureteritis and cystitis.

**Duration.**—Cases may begin in childhood, last fifteen years or more, and recover under proper treatment.

Cases have been known to last as long as thirty years.

On the other hand a patient may after the age of fifty pass a stone and not be troubled again during life, especially if he obtain proper treatment.

In chronic cases nausea and persistent headache point to uræmia, while splenic and hepatic enlargement suggest amyloid kidney.

**Prognosis.**—Immediate, generally favorable. Successive attacks not necessarily fatal.

Continuous presence of stone in the pelvis is a menace to health, on account of possibility of production of serious renal inflammations and degenerations.

Anuria is a serious complication; not always fatal, even if it continue twenty days.

Repeated attacks of pain or the occurrence of pyelitis are a source of danger and call for surgical interference.

After passage of the stone, if possible per urethram, recurrence does not necessarily take place.

The prognosis is serious when pyelo-nephritis is present or contracting kidney.

**Treatment.—Preventive:** If calculus is suspected, great care must be taken to avoid violent, and particularly sudden, exertions, jolts, falls, or the lifting of heavy objects.

In case of uric acid calculus non-nitrogenous food, with avoidance of sweets, is essential.

All circumstances which favor the deposit of the various urinary salts in the kidneys should be guarded against. The not infrequent habit of drinking beer and eating heartily of meat, after exercise and profuse perspiration, is to be condemned, as it is conducive to hyperacidity of the urine on the following day, which in turn makes likely the deposit of uric acid crystals in the kidneys. Those who live in limestone districts should avoid, if possible, the hard water of artesian wells. It is now possible to purchase a complete apparatus for the distillation of water at a comparatively cheap price. Fifteen dollars will buy a still which will distill enough water for the use of a family of four people at a cost of about fifty cents a month. Those who can afford it should procure this apparatus. The writer has used distilled water as a beverage for several years, and finds it sufficiently palatable. In persons whose urine is habitually strongly acid and prone to deposits of urates or uric acid, regular ingestion of not less

than three pints of distilled water daily should be observed, meat should be eaten moderately, sweets, fats, beer and champagne avoided altogether.

Those subject to intestinal indigestion and deposit of oxalate crystals should avoid apples, spinach, tomatoes, sorrel, bananas and rhubarb, and take digestive tablets with meals at times when there are digestive difficulties. Hard water, tea and cocoa should be carefully avoided by them. In cases where the urine is alkaline and cloudy from phosphatic sediments, five-grain doses of Urotropin may be taken occasionally to give the urine its normal reaction and prevent decomposition of mucus. See also PHOSPHATURIA.

As a rule, open air life, with ingestion of plenty of soft water and use of a simple dietary, is a good prophylactic against stone. Sedentary or luxurious habits, rich foods and alcoholic drinks seem to be conducive to stone formation.

The patient should avoid foods containing the nuclein bodies as the thymus, spleen, brains, lymphatic glands, liver and kidneys.

Vegetables and fruits should be eaten, especially oranges, and alkaline waters drunk except in the case of phosphatic calculi. Cream should be avoided.

Tepid baths (95° F.) taken twice daily are said to be useful.

Massage once or twice a week and frequent rubbing with rough towel or flesh brush are helpful. Daily massage of the affected side should be practiced. Sexual excess should be avoided.

Alkaline mineral waters are useful: Londonderry, Buffalo, Geneva, Waukesha, imported Vichy and Saratoga. It is possible that artificial waters act even better, as, for example, those made by adding lithium carbonate to charged water, or sodium or potassium bicarbonate. A very efficient water of this class is the White Rock Lithia.

R. H. Fitz recommends a benzoated water, as follows:

Fifteen grains each of lithium benzoate and carbonate to-

gether with twenty grains of potassium bicarbonate, are dissolved in a pint of carbonic acid water. Dose, two pints daily.

Piperazin in doses of five grains, twice or thrice daily, in large quantities of water, is of value in dissolving uric-acid calculi. The dimethyl-tartrate (lycetol) is perhaps better than the pure piperazin, in doses from four to eight grains, so as to give in all not more than twenty-four grains *per diem*.

Lysidin is used as a uric solvent in doses of 10 minimis of the 50 per cent. solution largely diluted with water, three times daily.

The salts of lithium in seven and a half grains (0.5 gm.) doses are favorite solvents. Benzoic acid in the same dose may be given. Urotropin is also used.

It is claimed by von Noorden and others that Calcium Carbonate in doses of from ten to fifteen grains, three times daily prevents the formation of calculus.

Other solvents are Magnesium Borocitrate (15 grains in 3 fl. oz. of water,) a tablespoonful every hour; Uricedin seven and one-half grains (0.5 gm.) four times daily. (See Uric Solvents).

Those subject to phosphatic calculi should avoid excess of vegetables and fruit and take the following mixture: dilute Hydrochloric acid and dilute Nitric acid, each thirty minimis, distilled water, six fluidounces, syrup of red raspberry, one-half fluidounce, mix and take one tablespoonful (15 c.c.) every two hours.

**Uric Solvents.**—Numerous preparations known as uric acid solvents are now to be had. Among them the following:

Acetyl-methylene di-salicylic acid, known as Ur-a-sol; dose five to twenty grains. Acetyl-methylene di-salicylate of Theobromin, known as Diurazin, dose five to twenty grains, also a diuretic and said not to depress the heart; dimethyl-piperazin, sidonal, uricedin, lycetol; tetra-ethyl-ammonium hydrate: dose, five to ten minimis of a ten per cent. solution, three times daily, after meals, well diluted with water.

The dissolving powers of any uric acid solvent is according

to Vicario measured by the solubility in water of the urate formed by the solvent in question in the body.

Weiss has found in quinic acid a preparation which is capable of stopping the formation of uric acid in the system, and thus accomplishing something which is of the greatest importance to us in the treatment of gout. This quinic acid has been combined with piperazin, forming a most desirable, agreeable and easily dispensed product, known as Sidonal.

The dose is five grammes (77 grains) a day given in aqueous solution, one-half in the forenoon and the other half in the evening.

According to Vicario, urotropin and piperazin urates are eight times more soluble than lithium urate. Lysidin urate is twenty times, and dimethylpiperazin urate is twenty-three times more soluble than lithium urate.

The origin and prophylaxis of *oxalate calculi* have been studied by C. Klemperer, of Berlin, who declares that these stones are more frequent than is usually assumed. Their production is favored by foods rich in lime, as well as by substances containing oxalic acid, as vegetables, and glycocol and kreatinin, which are derived from it, produce it. He recommends magnesium as a solvent, which is present in meat and in the leguminosæ, while milk is not to be advised, as it is rich in lime and poor in magnesium. He, therefore, would have such patients take magnesium sulphate in doses of about two grammes a day. Senator thinks the stand of Dr. Klemperer well taken, for it explains the oxaluria of young children who use milk so much.

**Symptomatic Treatment.**—The principal remedies are *Argentum nitricum* (dull aching pain across the back and extending to the bladder, dark acid urine containing uric acid).

*Berberis* (in renal colic with sharp stitching pains and red sediment in the urine).

*Calcarea carb.* (in high potencies for renal colic).

*Cantharides* (in children with gravel, and also for the pains and congestion during passage of calculi).

*Coccus cacti* (lancinating pains and red sand in the urine).

*Cannabis* (urging to urinate with much straining).

*Dioscorea* (pain shooting into the testicles and leg, with cold, clammy sweat over the body).

*Lycopodium* (dull pain relieved by micturition; renal colic, especially of the right side; urine scanty, high colored; red, sandy deposit composed of urates and uric acid; urine sometimes contains mucus and pus, causing a whitish sediment. Greasy pellicle on the surface of the urine; itching in the urethra during and after micturition).

*Nitric acid* (oxalate calculi).

*Nux vomica* (pain extending from the renal region into the genital organs or leg, usually associated with intense and continuous backache; painful, ineffectual desire to urinate; urine passed drop by drop, with burning, tearing pains at the neck of the bladder. Acts best on the right side. Reddish urine with brick-dust sediment; burning and lacerating pain in the neck of the bladder during micturition. Use third decimal).

*Phosphorus* (bloody urine or brown urine with red sand; smarting and burning in the urethra, with frequent desire to urinate).

*Pareira* (taken in doses of four or five drops of the tincture at the first warning of the attack of renal colic, especially if the latter begins with pain in the glans penis, followed by tenesmus of the bladder and rectum; severe pains down the ureters, extending into the thigh; urine ammoniacal; paroxysm occurring usually in the early morning from 3 to 6 o'clock; pains in the thighs extending down to the feet).

*Sarsaparilla* (frequent urging to urinate with scanty but painless discharge; urine slimy, flaky, clayey or sandy).

*Sepia* (constant desire to urinate, with painful bearing down in the ureters in the morning; urine turbid with red sandy sediment).

*Pichi*, in renal colic from uric acid calculi,  
*Tabacum*, when there is collapse from extreme pain,  
*Thlaspi bursa pastoris*, in uric acid gravel with haematuria,  
Other remedies are Nitric or Nitro-muriatic acid, Pulsatilla, Sulphur, Benzoic acid, Boro-citrate of Magnesium, Chininum sulph. and Sarsaparilla. When the urine is alkaline Carleton advises Phosphoric acid, Phosphorus and Magnesia phos.

**Treatment of Renal Colic.**—When this occurs, the patient, if not gouty, should be given a *hypodermic of Morphine* if the pain is agonizing, as it usually is. Heat tends to relieve the pain, and a *hot bath* is often serviceable. Hot applications to the loins should be made if possible, and the patient should drink freely of water, weak tea, hot lemonade or barley water. The hypodermic of Morphine may be given in the dose of  $\frac{1}{8}$  to  $\frac{1}{2}$  grain with  $1\frac{1}{2}$  grain of Atropine sulphate, or, as suggested by Eichhorst, Morphine hydrochlorate, four and one-half grains; Glycerine and water, each seventy-five minims; mix, and give a hypodermic dose of from four to eight minims. To be preceded by large rectal enema. Suppositories of Opium and Belladonna will palliate the pains.

Carleton calls attention to the fact that in gouty patients the use of Morphine may be the direct cause of instituting an attack of gout. The writer knows of one case in which the hypodermic of Morphine was said to have been the cause of narcosis and death.

A change of position should be tried by the patient as relief from pain sometimes follows it. Manipulation of the abdomen is frequently of great service.

*Chloroform* is serviceable in prolonged cases, the pain being allayed by frequent whiffs.

*Citrate of potassium* may be added to water which the patient drinks in doses of from fifteen to thirty grains.

*Glycerin* should be given after the acute attack is over in doses of from one to four fluidounces in equal parts of water, one dose only daily and between meals. It may cause head-

ache and diarrhoea, hence it is best to begin with doses of half an ounce and increase daily. It shortens the attacks, lessens or stops the dull lumbar pains frequently remaining after the attack, and postpones the returns of the attacks. Its use should be discontinued as soon as possible, as it may produce acute nephritis.

For the lumbar pains Phenacetin, Belladonna, Hyoscyamus, Codeine, Sweet Spirits of Nitre, Buchu and Uva ursi are recommended by Anders.

For *hæmorrhages* in the course of renal calculus various astringents may be given, as fluid extract of Ergot, Alum in ten or fifteen-grain doses, Gallic acid in twenty or thirty-grain doses; also, Hamamelis tincture, Trillium or Geranium in drachm doses. Tincture of Thlaspi bursa pastoris in half-drachm doses continued over a period of weeks may control hæmorrhage and aid the expulsion of sand.

The preparation already referred to of corn-silk, broom-tops and lithia is useful, in the writer's experience, for allaying irritation, increasing the flow of urine and promoting the expulsion of uric acid "sand."

**Surgical Treatment.**—During renal colic the passage of a full-sized steel sound into the bladder is said to favor the passage of the calculus by reflex action, causing the ureters to dilate and allowing the urine to push the stone into the bladder.

Repeated attacks of pain and the occurrence of pyelitis call for removal of stone by surgical means. The success of surgical treatment for this disorder is now such as make it desirable before the patient becomes a poor subject for operation.

The writer has referred a number of cases to Dr. Charles Adams, and thus far without a single death from operation.

After the removal of uric acid calculus the von Noorden and Strauss treatment of Calcium carbonate, ten to thirty grains, three times daily, may be of service in preventing further formation.



FIG. 25.—Renal calculus (actual size) removed by Dr. Chas. Adams, with perfect recovery.

In cases of *anuria* from impaction of stone nephrostomy or pyelostomy may be performed. The stone may be pushed either up or down in the ureter. In advanced pyelonephritis nephrotomy or nephrectomy is to be performed.

**Symptomatic Treatment After Operation.**—After surgical operations to relieve the pains and fever the following remedies may be indicated: Belladonna, Chamomilla, Digitalis, Laurocerasus, China, Cuprum, Nux moschata, Nux vomica, Veratrum album.

#### URETERITIS.

**Definition.**—Inflammation of the ureter.

**Etiology.**—The same as pyelitis. It must be remembered, however, that in the pyelitis secondary to cystitis the ureter is often but slightly involved, if at all.

**Pathologic Anatomy.**—Similar to that of pyelitis.

**Clinical Features.**—In *acute ureteritis* the features are (1) severe abdominal pain, chiefly on one side, beginning in the renal region and gradually extending to the bladder; and (2) tenderness and swelling of the vesical end of the ureter, which in women can be felt by the finger per vaginam.

**Diagnosis.**—The diagnosis must be made chiefly by exclusion. If there are no evidences of trouble elsewhere, and yet the urine contains pus and epithelial *débris*, especially in women, *after a cleansing injection*, it may be reasoned that the ureter is the seat, at least partially, of the inflammation. Often, however, there occurs what is known as *renal tenesmus*, violent and painful contractions of one or the other ureter and corresponding pelvis of the kidney, with marked tenderness or soreness under pressure of the latter organ, proceeding from morbid irritability of both structures.

The pains occur in paroxysms, which vary in frequency, duration and severity in different cases, according to the stage of the preceding ureteritis and the extension of the lesion to one or both sides. As a rule, it is confined at first to the

groin on one side of the body, and afterward to the corresponding lumbar region. In the more severe attacks, the pain, besides being violent in these situations, radiates to the hip, the outer and inner sides of the thigh, the knee, leg, and even to the toes. Cramps of the muscles of the lower extremity on the affected side also occur in these severe paroxysms. In the well-marked cases, attacks of this sort come on daily, or even several times a day. They are most frequent and severe during the menstrual periods. The patients describe them as occurring most often during the night. They awake with a pressing desire to urinate; the emptying of the bladder is accompanied by more or less pain and spasm, and its evacuation is followed by a cramp-like pain, ascending along the course of the ureter to the kidney, and radiating to the lower extremity. The patient sleeps, as a rule, on the affected side, with the face turned toward the pillow, and it is the habit of many to draw the opposite thigh up over its fellow against the abdomen. The pain is excited in the early stages by the marital relation, which in nearly all cases becomes intolerable in the advanced stages of the disease.

**Differential Diagnosis.**—To distinguish renal tenesmus from renal colic, make pressure over the ureter where it lies in the vesico-vaginal septum, or inject the bladder with warm water.

The pressure of the water, when sometimes only a few ounces are used, causes an irresistible desire to urinate, which, if not promptly relieved, is followed by the pain along the ureter and in the kidney, even in the corresponding hip and lower extremities, down to the ends of the toes. The patients recognize the pain produced in this way as the symptoms which have been their chief source of suffering. The attacks of renal tenesmus brought on by either of these procedures may last for several hours or days, and are frequently accompanied by great mental excitement and hysterical manifestations. Hence the necessity of caution in adapting these means to the peculiarities of the case.

In *chronic* cases we find the following:

1. Increased frequency of urination, greater when standing, not absent when lying down.
2. Bearing-down pain, also increased by standing.
3. Tenderness felt, and desire to urinate excited when pressure is made over the curve of the ureter.

**Prognosis.**—Urteritis without renal tenesmus has the same prognosis as pyelitis. With renal tenesmus prognosis is less favorable.

**Treatment.**—The same as for pyelitis in cases unaccompanied by renal tenesmus.

For the thickening of the ureters *Hydriodic acid* has been used with apparent benefit in one of the writer's cases, given in the form of syrup.

The treatment for renal tenesmus is surgical, and is called kolpo-uretero-cystotomy. An opening through the vesico-vaginal septum not smaller than a silver half-dollar is made, having specific and close relation to the outlet of the affected ureter and kidney.

## CHAPTER XV.

### VARIOUS ABNORMAL STATES OF THE URINE : LITHURIA, OXALURIA, PHOSPHATURIA, CHYLURIA, HEMATURIA, HEMOGLOBINURIA, ETC., ETC.

**Lithuria : Synonyms.**—Uraturia, uricaciduria.

The terms lithæmia and uric acid diathesis are also used more or less synonymously with the above.

**Definition.**—The voiding of urine containing a brick-dust sediment composed chiefly of urates of sodium, potassium, etc., and of uric acid. In a large majority of these cases an actual relative excess of uric acid in solution is to be found in the urine, thus differing from phosphaturia, in which the writer usually finds actual diminution of phosphoric acid, and from oxaluria.

According to Sir Henry Thompson, if, without any errors of diet, a patient under 40 habitually passes urine which soon deposits a pinkish sediment, or which, though clear when voided, soon becomes thick and opaque, or covered with a delicate film or pellicle exhibiting faintly a play of prismatic colors—or if in a few hours there is seen in the sediment a deposit of free uric acid—"red-pepper crystals"—there is undoubtedly an undue tendency, either inherited or acquired, to produce uric acid.

The sediment occurs under various physiological conditions as, for example, in winter, when the urine for any reason is concentrated or highly acid. It is found in a large number of diseases of which acute inflammatory diseases, as rheumatic fever, the crisis in continued fevers, renal congestions, and various hepatic disorders are most prominent.

It has lately been pointed out by Dr. C. Rattlett, in a paper

on "The Clinical Relations and Diagnosis of the Uric Acid Diathesis," that the diagnostic value of the discovery of uric acid sediments in the urine depends entirely upon the associated clinical phenomena and the life-history of the patient. Such sediments, as he shows, are found where there is not necessarily an excess of the acid; they are very common in normal urine which has been allowed to stand for more than twelve hours; where the urine is highly concentrated or excessively acid; where there has been free indulgence in highly nitrogenous diet or in rich food; in cases where there is relative or absolute hepatic insufficiency; also in the profuse pale urine, with low specific gravity in the neurotic and hysterical, where the absence of the usual urinary pigments tends to precipitate the uric acid. As he further points out, any deficiency in the oxidation-changes in the system causes an increase in uric acid deposits, which are accordingly found in connection with cardiac and respiratory disorders, and in cases of post-nasal adenoids; also in many liver affections, due here to deficient oxidation of waste matters.

The presence, therefore, of these uric acid sediments in the urine is not diagnostic of the condition called so frequently the uric acid diathesis, except where a careful examination reveals the presence of the essential characteristics of gout at some time in the history of the case; or a well-marked gouty ancestry.

According to Richardson, in gouty people there is an exaggerated tendency to premature deposition of uric acid from the urine, and the degree of this exaggeration may be estimated by preserving specimens of the urines of several days (of twenty-four hours) in corked phials in a warm place, as the warmth checks the deposition of amorphous urates, and guarding from fermentation and putrefaction by adding a few drops of chloroform. Should crystals appear in the course of a few hours, regularly, this shows a tendency to gravel, or the uric acid diathesis; should no uric acid be thrown down

in the first twelve to twenty-four hours or more, the absence of such tendency is quite probable.

According to Wyeth, the presence of uric acid crystals in urine which has not been passed more than three or four hours has a pathologic significance scarcely less than oxaluria, and hence is a contra-indication to a serious surgical operation.

**Pathology.**—According to Croftan, whatever the primary or remote cause, the nature of the taint remains excessive nuclein-catabolism—*i. e.*, a tendency on the part of the uratic subject to disintegrate a quantity of nuclein in excess of the normal. At first the normal oxidation processes are capable of converting almost all the nuclein into uric acid, which is duly excreted by the kidneys; at the same time small quantities of the poisonous alloxuric bases are formed; they enter the circulation and pass through the kidneys, exercising all the while the toxic influence they are capable of exerting—*i. e.*, they produce a variety of functional disorders and probably lay the foundation of the anatomical changes they can produce in the kidney parenchyma. As the self-intoxication progresses in severity, vital processes fall below par and therewith oxygenation is reduced. This adds a second factor to the primary cause of the trouble, because with deficient oxygenation even less of the nuclein that is being disintegrated in excessive quantity can be converted into innocuous uric acid, and more of the toxic alloxuric bases are necessarily formed in its stead. While oxidation is still up to par, uric acid is excreted in increased quantity; as oxygenation grows more and more deficient the excretion of uric acid diminishes. The sum of uric acid and alloxuric bases excreted, however, remains uniformly high at this stage. As the disease progresses in severity, whether in the natural course of the affliction or aided by indiscretions in the mode of life, diet, alcoholic excesses, etc., the perversion, too, progresses in severity, more alloxuric bases are formed, and the process of

chronic intoxication goes on. It is during this period that in all probability the inflammatory and necrotic changes occur in the joints, kidneys and elsewhere that prepare a field for the formation and deposit of urate concretions. Virchow calls attention to the analogy that exists between the distribution and localization of these urate deposits and the manifestly secondary deposits of calcareous matter found in a variety of chronic diseases. The urate concretions themselves act as local mechanical irritants and may, of course, just as any other foreign body, set up what we may call tertiary inflammatory changes in the joints and kidneys. In the last stages of the intoxication, finally, where cachexia is extreme, oxygenation reduced to a minimum, where destructive tissue changes have taken place, the formation of uric acid ceases altogether, and only alloxuric bases are poured into the blood in proportion to the (reduced) quantity of nuclein that is still being disintegrated. At this period both the excretion of uric acid and the formation of urate concretions ceases; the alloxuric bases are excreted in large quantities. Finally, the kidneys become incapable of excreting any of the solids, and acute alloxuræmia, "uræmic poisoning," leads to the *exitus lethalis*.

In outline this may represent the pathogenesis of so-called uric-acid lesions. Certain cases remain stationary and never progress further than the stage of functional disorders, with increased excretion of alloxuric bases; others gradually enter the stages of concretions—*i. e.*, gout, nephritis, etc.; only a small part reach the terminal stage.

**Clinical Features.**—These are essentially as follows:

1. Mental irritability or depression, and easily induced exhaustion.
2. Headaches, insomnia, or restless sleep.
3. In some cases more or less persistent pain above the symphysis pubis like a neuralgia.
4. More or less frequent attacks of lumbago.
5. Various gouty phenomena.

## TREATMENT OF LITHURIA.

**Hygiene.**—The patient is to avoid tobacco, alcohol, sweets and excess of nitrogenous foods, to drink freely of soft water, and to get as much fresh air and moderate exercise as possible. Bicycle riding, not carried to excess, is certainly good, as also golf, automobile riding and horseback riding.

The patient needs much sleep in a well-ventilated room. The sleep of lithæmics is likely to be a restless one, but it frequently happens that after a restless night a patient may enjoy a restful slumber, between the hours of six and nine in the morning. On this account he should not arise early, unless it is absolutely necessary. Early rising is as a rule bad for lithæmics, who in many cases are at their worst in the early morning. Massage, hydrotherapy and electrotherapy may be used for their tonic effect.

In support of the writer's experience is the clinical view of Tyson, who says:

"An abundance of alkaline water, especially between meals, or, in the absence of alkaline waters, of plain water, and the exclusion of proteid foods to a degree sufficient to eliminate uric acid from the urine, accompanied by a liberal amount of out-door exercise, is to-day, as for some time past, the treatment of the uric acid diathesis in whatever form it manifests itself. Moreover, as the condition constitutes, as it were, a peculiarity of the individual which, while capable of being held in check, is scarcely eradicable—especially in hereditary cases—the treatment must be kept up for a long time, indeed in certain cases never interrupted, except for a short time, for the condition is almost sure to reassert itself. For articular deposits and swellings, massage is the most valuable treatment, especially when taken in connection with warm baths."

**Diet.**—The patient should avoid coffee and beer. The

latter especially in the writer's opinion is very injurious to the lithæmic. The liver, spleen, thymus glands, and kidneys of animals are forbidden. Raw meats and smoked meats contain the extractives, and are consequently not suitable articles of diet for a uratic case. Soups, meat extracts, sauces, etc., are especially unsuitable, as they contain the extractives in concentrated form; boiled, stewed, and fried meats of all kinds, on the other hand, are permissible.

Eggs and milk are suitable food; it is true they are both rich in nucleins, but of a different kind to those found in the internal organs and in the blood. (Croftan.)

In the writer's opinion it is not wise to forbid meat altogether, as Croftan says:

"Proteids produce a transitory digestion leucocytosis, and should in consequence be interdicted on the theoretic grounds; the bad effects, however, that might be postulated from these for a uratic case are fully counter-balanced by the good effects in the direction of increased nutrition and resisting powers that accrue from an animal diet. Some discrimination will have to be exercised according to individual idiosyncrasies, and a great deal will depend upon the kind of proteid food and its mode of preparation."

The following table, quoted by Carter, is of interest:

## URIC ACID IN FOODS.

Substance.	<i>Uric acid and Xanthins:</i>	
	Per cent.	Grains per lb.
Lamb (cold roast leg), . . . . .	.0500	3.50
Soup (made from bones), . . . . .	.0068	0.48
Soup (made from meat), . . . . .	.0202	1.40
Hospital beef-tea (cooked 8 hours), . . . . .	.0980	7.00
Saddle of mutton, . . . . .	.0200	1.40
Mutton (cold roast leg), . . . . .	.0160	1.10
Veal (cutlet), . . . . .	.0490	3.50
Beef (cold sirloin), . . . . .	.0160	1.10
Kidney of Sheep, . . . . .	.0190	3.50
Liver of Sheep, . . . . .	.0910	6.50
Fowl (breast), . . . . .	.0240	1.70

<i>Substance.</i>	<i>Uric acid and Xanthins:</i>	
	<i>Per cent.</i>	<i>Grains per lb.</i>
Rabbit, . . . . .	.0150	1.00
Mackerel, . . . . .	.0320	2.00
Mackerel (boiled 15 minutes), . . . . .	.0150	1.00
Plaice, . . . . .	.0039	0.20
Herring (fresh), . . . . .	.0040	0.20
Herring (Loch Erne, kippered), . . . . .	.0900	6.40
Herring (bloater), . . . . .	.0310	2.20
Beefsteak (treated raw), . . . . .	.0190	1.30
Meat juice, . . . . .	.6970	49.70
Meat extract, . . . . .	.8830	63.0*
Tea, . . . . .	2.5000	175.00
Coffee, . . . . .	1.0000	70.00
Cocoa, . . . . .	.8400	59.00

Eggs, however, do not agree with many, nor does milk. Some caution must be observed in regard to these articles, not on theoretical grounds, but because of the difference in the digestive power of patients. Raw eggs whipped in cream may usually be allowed. There are also those patients who should be forbidden heavy meats, cheese, ripe peas and beans.

In most cases milk, with whole wheat bread thoroughly baked, rice, oatmeal, barley and rye meal, and fruits, will constitute an ideal diet.

In general the food should be sufficient for proper nourishment only, the proteids being made up from the lighter meats.

Yeo suggests a simple dietary of pounded meat and plenty of hot water.

**Hygiene and Climatology.**—The lithæmic patient needs air. Open windows at night, fresh air in the daytime, bicycle-riding and mountain-climbing are of the utmost value. The amount of exercise is to be regulated by the pulse. Those with a slow, but not tense, pulse can endure with impunity exercise which would be violent and dangerous for others.

Change of climate is beneficial. In the writer's experience, dry, mountainous regions are preferable to the seashore. The author's favorite prescription for lithæmics is two weeks at

Saratoga, with drinking of Congress or Hathorn water, followed by three weeks in the *mountainous* portion of the Adirondacks, at either Lake Placid, Adirondack Lodge or St. Hubert's Inn, according to the tastes of the individual. A week at each one of the above-named places is advisable for those unfamiliar with the Adirondacks, so that in subsequent visits the one best-liked may be selected from experience. Lake Placid is enjoyed by those who like a beautiful mountain lake with extensive views; Adirondack Lodge by those who prefer to be in the heart of a primeval forest in the foot-hills of the highest mountains, and St. Hubert's by those who like the diversity of valley, mountains, lakes and forests. While the Adirondacks are well known to those in the East, the benefits of their climate are comparatively unknown to Western people. Not of little importance is the purity of the spring water in the mountain regions named above. An additional advantage is the proximity of chains of lakes where those fond of boating and fishing can find all they desire.

**Mineral Waters.**—For the lithæmic, waters containing *sulphate of soda* are by far the best; alkaline waters, like Vals, Vichy, etc., may cause the urinary sediment to disappear temporarily, but their curative range is limited. The best known sodium sulphate waters are Pullna, Hunyadi Janos, Friedrichshall, Marienbad, Carlsbad, Rubinat, and Kronenquelle.

The full dose of Hunyadi Janos is from five to seven ounces taken an hour before a light breakfast, during which a cup or two of some hot liquid is to be taken.

Marienbad water is far more agreeable than Hunyadi Janos, since it contains no sulphate or magnesia. Dose, half a pint or more. Carlsbad contains no magnesia. It is best suited to robust patients.

Sir Henry Thompson recommends Carlsbad water to which a little Hunyadi Janos is added. From four to seven ounces of Carlsbad at a dose, heated, to which as much Hunyadi Janos is added as is demanded by the bowels of the patient.

In America the best saline waters are probably the Congress and the Hathorn, although others are now found in Arkansas which may prove valuable.

Searle thinks highly of an effervescent draught composed of dilute lemon-juice and bicarbonate of soda. A solution of Carlsbad salt and lithium benzoate has been recommended, and theoretically should be useful in several ways. French Vichy water certainly is of service in causing disappearance of the sediment and when there is indigestion and flatulence together with constipation. Allouez, Bear and Londonderry lithia waters are certainly serviceable.

The Londonderry charged water is especially popular owing to its well-known effervescent properties.

**Remedies.**—The principal ones are Bryonia, Cimicifuga, Colchicum, Lithium, Lycopodium, Nux vomica, Mercurius dulcis, Sodium glycocholate, Ferrum, Arsenicum, Oxygen gas, Sodium phosphate, Sarsaparilla, Hedeoma, Uranium nitrate and Ocimum.

*Lithium compounds* are used very extensively in the uric acid diathesis. White Rock Lithia water, Lithia tablets and Lithium benzoate have been used by the writer for dissolving the sediment of urates and for increasing the ratio of urea to uric acid in the urine.

The preparation known as Thialion, containing lithia and a saline laxative, is given in teaspoonful doses in a glass of water an hour before meals.

*Lithium benzoate* (2 to 10 grains) is satisfactory in dissolving the sediment of urates and increasing the urea-uric acid ratio in cases where the digestion is good and the stomach tolerates it.

*Dilute Nitromuriatic acid* (5 to 7 drops) in cases where hepatic symptoms are prominent.

*Cimicifuga* in drop doses of the tincture, for the lumbago of lithæmics, may be given, together with White Rock lithia water, which is an excellent water in cases of lumbago.

*Gelsemium* tincture is also serviceable for the myalgia.

For the lumbago so commonly occurring in lithæmics a porous plaster to support the muscles and furnish warmth, or rubbing with a liniment, as of Chloroform and Aconite, or the use of static electricity may also be of service.

*Hedeoma polegioides*, according to Paul Allen, produces the symptoms of lithæmia. It has been proved to be of clinical value by Carleton. There is the characteristic mental depression, flatulency and dragging pains of the lithæmic condition.

*Nux vomica* is serviceable in constipated subjects and when the usual indications are present. Nux and Calcarea carb. or Phos. are good remedies for lithæmic children, in the third decimal.

*Glycerophosphates*.—The Lithium Glycerophosphate may be given when, in addition to the low urea-uric acid ratio, we find also a high ratio of urea to phosphoric acid. In such cases nervous depression and insomnia are features.

*Acidum hydrochloricum*.—Hydrochloric acid in two-drop doses after meals, in water, may be given those patients whose lithæmic condition is due to the imperfect digestion of proteins from a lack of hydrochloric acid in the gastric juice.

*Sodium phosphate*.—This is the best laxative for many lithæmics; to be taken in thirty-grain doses in half a glass of water on rising and on retiring.

*Iron and Arsenic*.—Croftan believes in treating lithæmia as a secondary anaemia, with Blaud's pill separately, and Fowler's solution in combination with medullary glyceride or haemabolics. In those cases of lithæmia where the gastric disturbances are neurotic in form, and accompanied by pain, often neuralgic in character, sour stomach and eructations, give the Fowler's solution in three-drop doses after meals.

*Oxygen*.—Croftan finds most gratifying results from inhalation of oxygen gas as follows: The gas is procured in cylinders. At each treatment about five gallons are allowed to

stream into a rubber bag with two stopcocks, and the patient inhales through a rubber tube and glass mouthpiece from the bag. Those physicians who are located at a distance from large centres, and who cannot obtain the gas in cylinders, can readily procure a simple form of oxygen retort and gasometer and generate their own oxygen at a very small expense. The patient is instructed to exhale thoroughly, then to fill the lungs with oxygen, to remove the tube, and to breathe a little more air until the chest is expanded to its fullest capacity. He is then instructed to hold the gas as long as possible and then to exhale slowly. This operation is repeated until the prescribed quantity of oxygen has been taken. By this method the gas is held for a time under pressure and the maximum absorption obtained. In the beginning inhalations are given daily, later every other day, and finally twice a week. Treatment should be given for a period of at least three months.

Dr. Croftan says the most striking results have been obtained in acute cases by inhalations of oxygen gas. On six occasions he claims to have aborted an attack of gout by inhalations of oxygen repeated at short intervals. He believes, too, that he can invariably relieve, if not cure, a uric-acid headache, a migraine, in short, lithæmic attacks, by oxygen inhalations.

#### OXALURIA.

**Definition.**—The voiding of urine containing crystals of calcium oxalate, while at the same time the patient complains of certain nervous or digestive troubles, or both. The deposit is not necessarily associated with increase in the total quantity of calcium oxalate in the urine.

**Associated Disorders.**—Jaundice, spermatorrhœa, disturbances of digestion and neurasthenia.

**Etiology and Pathology.**—The origin of oxalic acid in the body is obscure, and the quantity of it in the urine is not in-

dicated by the number of crystals in the sediment. The acid sodium phosphate of the urine holds the substance in solution, and the crystals form during progressive decomposition of the phosphate. Certain articles of diet, as apples, tomatoes, bananas and rhubarb favor their formation, and, in the spring of the year, when rhubarb is eaten, the writer finds always an increase of the oxalate crystals in samples of urine examined.

**Clinical Features.**—These are usually the following:

1. Digestive disturbances, particularly flatulence.
2. Inability to retain the urine when desire for micturition comes.
3. Mental and physical fatigue from slight exertion; listlessness.
4. Nervous symptoms: headache, wakefulness, mental depression, hypochondria.
5. Backache or lumbar pain, generally on one side, and sometimes severe; perhaps due to mechanical irritation of ureter by the crystals.
6. Acute intercurrent attacks of prostato-urethritis, perhaps due to irritation from the crystals.

**The Urine.**—According to Heitzmann the typical condition of the urine is as follows:

1. Quantity per 24 hours: decreased.
2. *Color.*—Increased.
3. *Reaction.*—Acid.
4. *Specific Gravity.*—High, 1.025 or upwards.
5. *Sediment.*—Crystals of the oxalate occurring as octahedra, disks, spheres or dumb-bells.

Some authors hold that the crystals are found mainly in alkaline urine, but the writer has shown by a large number of analyses that this is not true.

The writer finds a sediment of calcium oxalate very common in diabetes mellitus, and it is said that oxaluria may be followed by glycosuria.

Patients who have sediments of urates or uric acid in their

urine frequently show oxalate either accompanying the former or alternating with them.

The chief danger in these cases is the possible formation of calculus. In the writer's experience, confirmatory of Dr. Beale's statement, the dumb-bell crystals are to be regarded as minute calculi. For example, in January, 1898, a patient complaining of lumbar pain brought urine for examination: dumb-bell crystals, octahedra and concretions were found in the freshly-voided urine. Diagnosis of oxalate calculus was made, and in March the patient voided a small rough stone of that variety.

In a number of cases, however, where the dumb-bell crystals have been found by the writer no history of calculus has as yet been obtained, nor symptoms noticed.

In general the oxalate sediment is a sign of impaired digestion, hepatic or intestinal.

**Relation to Surgical Operations.**—According to Wyeth the presence of oxaluria is a contra-indication to a serious surgical operation, for the reason that it is pathognomonic of a disturbed nutrition due to insufficiency of the digestive fluids and to fermentative processes in the intestinal tract.

Williams thinks that the excretion of oxalate crystals by the kidney may, by irritation, lead to true nephritis.

#### TREATMENT OF OXALURIA.

**Climate and Hygiene.**—The oxaluric patient does better in dry climate. He should avoid damp or clayey soil and sleep as high from the ground as possible. Camping out in the mountains of the West has repeatedly been of benefit to my oxaluric patients. The sea-shore is not so well suited to them.

A cold compress over the abdomen at night, as recommended by Ralfe, has relieved some of the writer's cases in which flatulence was complained of.

Diet.—Patient should avoid articles of diet rich in oxalic acid, as apples, bananas, rhubarb, tomatoes, etc.; all sweets and sweet or carbonated drinks, such as are usually sold at soda-fountains, and indigestible materials generally. Hard water is to be avoided. Distilled water is probably the best drink. Diet composed chiefly of meat is thought to be best. The patient may take stale bread, fresh roe, and the brains of animals, but should avoid tea, coffee, and alcoholic drinks.

Remedies.—The principal remedies are dilute Nitrohydrochloric acid, Basham's mixture, Hydrangea, Oxalic acid, Kali sulphuricum, Senna and Berberis.

*Acidum nitromuriaticum* is a frequently employed remedy in cases of young men with sediment of oxalate crystals in the urine and complaining of malaise, great repugnance to mental and physical exercise, and depression of spirits.

In each case make up a fresh preparation of dilute Acidum nitromuriaticum as follows: Mix Nitric acid, four parts by weight, with Hydrochloric acid, fifteen parts by weight, in a large glass beaker. When effervescence has ceased, add seventy-six parts by weight of distilled water and mix well. Give five to seven drops of this freshly-prepared acid three times daily, *after* meals. It is held by some authorities that after mixing the strong acids the mixture should stand four weeks, until it turns brown, before dilution and administration.

*Lysidin* is properly a uric solvent but it has apparently helped one or two cases of oxaluria in the writer's practice. It may be had in form of 50 per cent. solution, the dose of which is usually ten drops three times daily. The indications for Lysidin are said to be irritability of the bladder, irregular heart action, and nervous symptoms. Its action is usually speedy, which is fortunate, owing to the cost of the substance. The dose should be well diluted with water.

The two cases in which I have used it were very different in character, one being a young man whose affection was com-

paratively recent, the other in an older man with a long-standing oxaluria. In the second case the distressing pain in the lumbar region was apparently relieved by a few doses of a few minimis of the agent, after having persisted for a number of days. The second case is particularly worthy of mention, as various measures had failed to relieve the pain in the past, and also during the present attack.

Both patients however, were rather skeptical as to the value of the remedy despite the fact of their improvement.

Basham's tincture in doses of from two to four teaspoonfuls, and tincture of Hydrangea in ten-drop doses have been recommended.

From a strictly homœopathic standpoint oxalic acid in potency is said to be curative and adapted to those cases in which there is burning during micturition, and backache.

Kali sulphuricum is used by Hærman, of Paris, and was indorsed by the late T. F. Allen for oxaluria.

#### PHOSPHATURIA.

**Definition.**—Clinically, by phosphaturia we mean the voiding of urine containing a phosphatic sediment. The term "excess of phosphates" is used synonymously, but if this means excess of the total  $P_2O_5$  in the urine it is incorrect, for only in rare cases do we find this excess, and to such cases the term phosphatic diabetes has been given, when the quantity is far above three grammes per twenty-four hours.

**Etiology.**—The cause of the sediment is deficiency of acidity on part of the urine, with sometimes a relative excess of earthly phosphates, as compared with alkaline ones.

The causes of persistently alkaline urine are as follows :

1. Food or drink abounding in alkaline salts, as alkaline mineral waters.
2. Indigestion due to hypochlorhydry.
3. Ammoniacal fermentation of the urine in the renal pelvis or bladder.

The disorder is therefore either functional or secondary ; it also occurs in cases of chronic prostatitis with prostatorrhœa.

**Clinical Features.**—These are usually the following :

1. Mental and physical weakness.
2. Backache and sexual weakness
3. Neurasthenic or hypochondriacal symptoms.

The writer has, however, seen obstinate cases in which no symptoms at all other than the condition of the urine were complained of, but the sediment in the urine caused anxiety on part of the patient.

The chief danger in these cases is the formation of calculus.

**The Urine.**—The essential features of the urine are as follows :

1. Color not increased, usually diminished to lighter than normal.
2. Urine turbid when freshly voided.
3. Reaction less acid than normal ; may be neutral or alkaline.
4. The urine, when heated, becomes cloudy, but the cloudiness disappears in great part when five or ten drops of 20 per cent. acetic acid are added, care being taken to shake the tube after such addition. At the same time effervescence may be noticeable.
5. The urine on standing deposits an abundant whitish flocculent sediment. Removed with a pipette, this sediment is more or less soluble in 20 per cent. acetic acid.
6. In some cases the sediment is so abundant as to pass out at the end of urination as a white or creamy mass, alarming the patient, who mistakes it for semen.

#### TREATMENT OF PHOSPHATURIA.

**Diet and Hygiene.**—The patient should avoid hard water and in general adopt a nutritious diet ; he should have as much sleep and exercise in the open air as possible. Change

of climate often helps. Sexual intercourse is undoubtedly bad for those affected with phosphaturia and should be restricted to a minimum, or altogether forbidden.

**Remedies.**—The principal remedies are Urotropin, Nuclein, Arsenicum, Boracic acid, the Hypophosphites, the Glycero-phosphates, China, Phosphoric acid.

*Urotropin* is a valuable remedy in this condition in some cases acting very speedily. Dose, from five to ten grains in water, two to four times daily.

There are cases, however, in which it effects but relative improvement. Such cases need attention to the digestion and general health or removal of calculus if one be present.

*Nuclein.*—Inasmuch as phosphaturia is thought to be due to destruction of the nucleus of the leucocytes nuclein is advised in the therapy of this disorder. Its efficacy is said to be demonstrated within twenty-four hours, when an examination of the urine will reveal a decrease in the phosphates, and an examination of the blood will reveal that the number of lymphocytes is the predominant number of white corpuscles within the blood.

*Arsenicum.*—One of the worst cases of phosphaturia which the writer ever saw, with severe digestive disturbances, nausea, vomiting, and pain under the ribs was cured by three drops of Fowler's solution four times daily, Marienbad salts being also administered in the morning and at night, and lithia water taken as a beverage.

*Boracic acid.*—In cases where the sediment is very dense and the formation of calculus is feared the writer has been able to keep the urine in tolerably good condition by Ralfe's formula :

Boracic acid one hundred and twenty grains, glycerine one fluidounce, warm water eight fluidounces. This, in tea-spoonful doses, usually suffices to clear the urine. It should be made up fresh from time to time. The sediment may, however, return after its use is discontinued, unless in the meantime the patient's general health improves.

For the phosphaturia which sometimes persists after cystitis, injections of citric acid, five to ten grains in a pint of warm water, are recommended.

Following the paper of Robin in 1894 the writer called attention to the theoretical value of the glycerophosphates in phosphaturia. The wine of *phosphoglycerate of lime*, containing ten grains per fluidounce, is prescribed in doses of a tablespoonful or two, two or three times daily, at meals. Where alcohol is contra-indicated the syrup may be given in the same dose, or the capsules (four grains) in doses of one capsule three times daily. The dose of the above for children is one-half.

The *acid* glycerophosphates have been serviceable in one case which the writer has treated.

*Acidum phosphoricum*.—This agent by improving digestion and also acidifying the urine may be of service in phosphaturia. Use the first decimal.

For cases where there is marked deficiency of phosphoric acid with or without phosphatic sediment, as in neurasthenia, Addison's disease, etc., the writer gives the phosphoglycerate of lime, or a calisaya and phosphorus mixture, preceeded if necessary by mild purgation.

In obstinate cases Eichhorst suggests the following: Hydrochloric acid seventy-five minims, water six and a half fluidounces; one tablespoonful every two hours. The remedy should be used for a long time.

It is quite possible that some few obstinate cases of phosphaturia are due to non-suppurative pyelitis and decomposition of the urine in the pelvis of the kidney. Catheterization of the ureters or use of the segregator will determine whether the urine decomposes in the kidneys or in the bladder.

#### CYSTINURIA.

The occurrence of cystin in the urine is usually noticed after infectious diseases, in articular rheumatism and in syph-

ilis; the condition is also often peculiar to families. The diagnosis is made by the observation of crystals in the urine in the form of six-sided plates like uric acid, but the murexid reaction cannot be obtained with them. (See URINARY ANALYSIS, third edition.)

An odor of sulphuretted hydrogen noticed in stale urine in which there is no pus should direct attention to the possible presence of cystinuria.

The chief danger is that of formation of calculus.

The treatment consists of a diet of fresh meat and green vegetables, repeated colon flushings and administration internally of mineral acids and Salol.

#### OTHER ABNORMAL STATES OF THE URINARY SECRETION.

There are a number of abnormal conditions of the urine which can hardly be classified as separate diseases, but should rather be deemed accompaniments of various disorders.

*Albumosuria*.—The voiding of albumoses in the urine; this occurs in septic conditions, during pus formation in the body, in osteo-malacia, myxoedema and multiple bone tumors.

*Albuminuria*.—The voiding of serum albumin in the urine.

*Alkaptonuria*.—In pulmonary tuberculosis and after the administration of salicylic acid the urine on standing may become brown or red. Addition of potassium hydrate solution to the fresh urine causes immediate appearance of the color.

According to Eichhorst, Antipyrin may be given as a remedy, as follows: Antipyrin, 15 grains; sugar, 7½ grains; make ten powders; dose, one powder every three hours.

Syphilitic cases may be treated with Mercurial Inunctions and Potassium Iodide.

*Chyluria*.—The voiding of urine containing chyle, which occurs in minute particles in suspension in the urine, giving it a milky or opalescent appearance. It is due to the parasite *filaria sanguinis hominis*, or to obstruction of the thoracic

duct. The disease is endemic in the Orient, and is now attracting much attention; it also occurs in the West Indies, Cuba and Brazil, and we may expect to see cases of it now in this country in those who have returned from our new possessions. There is polyuria and the urine contains albumin, fibrin and blood-corpuscles. Coagulation of the chyle in the pelvis of the kidney may cause renal colic, and in the bladder may cause cystitis. In the latter case the mass must be dissolved by injections of an alkaline solution and withdrawn by the catheter. No other symptoms occur, unless the parasite becomes diseased, in which case general debility ensues. Death from the affection itself rarely occurs.

*Fibrinuria* occurs in the above sometimes in clots from haematuria, and rarely as a component of spiral membranes in membranous ureteritis.

*Diacetic-aciduria* occurs in diabetes where it is a sign of coma, and in febrile diseases of children, where it is unimportant; the urine contains diacetic acid and gives a red color with solution of ferric chlorid.

*Glycosuria*.—See diabetes mellitus.

*Hæmaturia*.—The voiding of urine containing blood-corpuscles. The source from which the blood is derived is not always easy to determine. The following method of diagnosis is useful :

When blood is found in the urine and doubt as to its origin or significance exists, recourse is to be had to the following clinical measures :

1. Examine the blood of the patient for parasites, especially the plasmodium.
2. Examine the urine both when blood is absent and when present. Dilute the urine with several times its volume of water in order to dissolve the blood and to reveal the presence of bits of growth.
3. Examine the bladder with sound and cystoscope.
4. Make physical examination of the region of the kidneys for presence of tumor.

5. Look into the family history and the history of the patient for haemophilia and examine the patient for superficial purpura.
6. Inquire into the possibility of intoxication by alcohol or chemical factors.
7. Ascertain whether there has been venereal disease or injury.
8. Examine the patient's sputum and urine for evidences of tuberculosis; also examine the testicles and seminal vesicles for evidences of the same.

In cases when the above are all negative the diagnosis by exclusion refers the haemorrhage either to calculus as a cause or to early stages of a growth.

**Appearance of Blood in the Urine.**—From the kidneys: usually well mixed, slight in quantity in nephritis, profuse when from growths or diseases of the renal pelvis. In nephritis the blood gives the urine a smoky hue.

Hæmorrhage from a *ureter* is manifested by long clots, like earth-worms in size and shape. Hæmaturia may alternate with normal urine when the passage is stopped. Blood from the *bladder* appears in large irregular bright red blood clots (sometimes dark brown, if urine quite alkaline) at the end of micturition. If the bladder is washed out with borax solution, until what comes away is clear, and the solution is again injected at once, it will come away bloody. Blood from the prostate appears toward or at the end of micturition, which is usually difficult. Bright blood from the anterior urethra is passed at the beginning of micturition or during the intervals, or can be stripped out. From the posterior urethra it is usually slight in quantity and comes at the beginning or end of micturition or both, sometimes clotting. Pink semen indicates a haemorrhage from the seminal vesicles. Blood from the vulva, vagina or uterus is readily distinguished by a history of menstruation, by inspection, by washing, and if necessary by catheterization.

Hæmaturia is due (*a*) to injury of the urinary tract, including injury from parasites and stone; (*b*) to the effect of drugs; (*c*) to inflammations; (*d*) to growths, syphiloma and tubercle; (*e*) to congestion, especially from cardiac disease.

The treatment is, if symptomatic, by administration of such remedies as Cantharides, Millefolium, Ipecac, Crotalus, La-chesis, Terebinth and Thlaspi bursa pastoris. Rest and liquid diet are advisable. In cases where the clots do not pass, catheterization may be necessary, but often a clot acts as a foreign body and ammoniacal decomposition of the urine results in dissolving it.

Carleton advises continuous catheterization, when the bleeding is excessive. The condition may yield to ten grains of Calomel and of Jalap, each taken at one dose.

In some cases perineal cystotomy is necessary, with continuous drainage to remove the clots.

*Hæmoglobinuria* (passage of blood-coloring matter with few or no corpuscles) may be due to secondary degeneration from tuberculosis and syphilis, or the dyscrasia and cachexia of cancer, infectious diseases, purpura, scurvy and malaria.

It is most commonly seen by the writer in children or infants with scurvy from artificial foods, and as a result of malaria. Connective tissue shreds are very abundant in the urine of children with scurvy, and there is a little albumin and a few casts at times. Severe cases present chill, sometimes preceded by colicky pains in the abdomen; subnormal temperature during the chill, nausea, vomiting, pain in the back and limbs, and retraction of the testicles; exhaustion, headache, thirst, coma, and sometimes jaundice or urticaria may follow. There is a tendency on part of the disorder to be paroxysmal; even in cases due to scurvy there will be days when the urine is free from the reddish deposit. It may apparently cease altogether, but return again after weeks or months. It is said that there is danger of termination in nephritis. In the new-born the disease may be epidemic in certain localities, and dangerous.

The treatment in general is that of acute nephritis. The best remedy in the writer's hands has certainly been Terebinth, given in the first decimal to children, the second to infants and in drop doses to adults. Other remedies recommended are Crotalus, Phosphorus or Ferrum phos., and Potassium chlorate. The value of Quinine is disputed.

*Hæmatoporphyrinuria*.—The voiding of urine, red when passed, and becoming darker on standing, from presence of a derivative of haemoglobin called hæmatoporphyrin. Found in excess in poisoning by sulphonal and trional and in the urine of typhoid and certain nervous diseases where it is regarded as of bad prognostic significance.

*Hydrothionuria*.—The voiding of urine containing sulphuretted hydrogen. Suggests absorption of this substance from bowel and hence auto-intoxication; or else abnormal communication between the intestine and urinary tract.

*Indicanuria*.—The voiding of urine containing excess of indican. Occurs in various intestinal troubles, especially in those of the small intestine. The treatment is that of the cause.

*Lactosuria*.—The voiding of milk-sugar in the urine. Occurs in pregnancy or after childbirth.

*Lipuria*.—The voiding of more than ten grains to the gallon of fat in the urine. Usually of importance in connection with various renal lesions, diabetes, or cancer of the pancreas.

*Lipaciduria*.—The voiding of fatty acids in the urine. Probably of no clinical significance.

*Lithuria*.—The voiding of urine containing a brick-dust sediment of urates and uric acid. Already considered.

*Melanuria*.—The voiding of urine, black when first passed, from presence of a black pigment, melanin; usually significant of melanotic cancer or sarcoma.

*Melituria*.—(See Glycosuria.)

*Mucinuria*.—(See Nucleoalbuminuria.)

*Nucleoalbuminuria.*—The voiding of urine rich in the substance formerly called mucin. Found in catarrhal affections of the urinary tract.

*Oxaluria.*—The voiding of urine containing crystals of oxalate of lime. (Calcium oxalate.) Already considered.

*Phosphaturia.*—The voiding of urine containing a sediment of phosphates.

*Peptonuria.*—(See Albumosuria.)

*Pyuria.*—The voiding of urine containing pus. Found in various affections of the urinary tract and considered in connection with them.

*Uraturia.*—(See Lithuria.)

*Urobilinuria.*—The voiding of urine containing excess of urobilin. Of special importance in cases of concealed haemorrhage, especially in ectopic gestation, indicating absorption of extravasated blood.

*Lævulosuria.*—May occur in cases of over-ingestion of cane or fruit sugars or in diabetes.

## CHAPTER XVI.

### DISEASES OF THE BLADDER.

The commonly recognized conditions are malformations, malpositions, dilatation, hypertrophy, atrophy, paralysis, irritability, circulatory disturbances, amyloid degeneration, inflammations (cystitis), tuberculosis, syphilis, tumors, cysts, parasitic diseases and calculus. The bladder may also be the seat of wounds or of rupture.

**Malformations.**—Absence of the bladder, with opening of the ureters elsewhere, as into the urethra or vagina, has already been referred to. It usually causes early death. Use of a urinal or implantation of the ureters into the rectum is the treatment. *Diverticula* may be present in the form of pockets or cells; a septum may divide the bladder, the condition being known as *bipartite bladder*. There may be multiple bladders. The treatment is drainage, if cystitis occur which does not yield to treatment.

*Patulous urachus* may occur as a congenital defect, and calculi or cysts be present in it. The urine in complete cases escapes at the umbilicus. The treatment is surgical.

The anterior wall of the bladder may be absent in the condition known as *exstrophy*. It is usually associated with malformation of neighboring parts, and is much more common in males than in females. As a rule death results in a few days after the child is born. Those who live are likely to die from urinary septicæmia or exhaustion. In rare cases the patient has good health. The treatment consists in the use of a properly fitting urinal. In cases where the condition is marked a surgical operation is required after the fourth year of life.

**Malpositions.**—The most common is vaginal cystocele, descent of the bladder into the vagina. In women prolapse of

the bladder through the urethra may occur. Hernia may also occur, but is rare and generally an inguinal cystocele.

If the abdominal or pelvic wall is defective, the bladder may be externally prolapsed.

Cystoceles increase and decrease in size according to retention or passage of urine. Effort should be made to reduce cystocele by means of a truss, otherwise surgical treatment is necessary by proper repair of the supports which are lacking.

**Dilatation.**—This is due to obstruction to the free flow of urine. In acute dilatation we find the bladder-wall thin and translucent, but in cases where the obstruction is moderate and long-continued the bladder-wall becomes hypertrophied, as when due to enlarged prostate. Riesman reports a case in which the bladder held 88 fluidounces of urine (2640 c.c.).

**Hypertrophy.**—This is due to an increased demand for contraction and is the usual result of cystitis or other causes of obstruction to the free flow of urine. It may also be congenital; rarely it is of reflex or nervous origin. Two kinds of hypertrophy are distinguished, concentric where the cavity is not larger than normal and excentric when it is larger. In marked cases of hypertrophy the bladder has a peculiar ribbed appearance in the interior with ridges and depressions; the latter may be filled with concretions or give rise to diverticula.

**Atrophy.**—This is usually due to old age or may result from prolonged distention.

#### IRRITABLE BLADDER.

**Definition.**—This is a tendency to frequent contraction of the bladder with evacuation of urine. If long continued, it may lead to hypertrophy.

**Synonyms.**—Neuralgia of the neck of the bladder. Frequent desire to urinate.

**Pathology.**—The prostatic sinus being congested and constantly more or less irritated from irregular or ungratified

sexual desire, the congestion extends readily in both directions, involving the cut-off muscles in front and creeping backwards into the neck of the bladder through the inner orifice of the urethra. The whole urethra is sensitive and irritable, but the bladder walls themselves are insensible when touched with the point of the sound. The cut-off muscles are excessively sensitive and irritable.

**Clinical Features.**—These are the following:

Frequent desire to urinate by day and during sleepless nights, but little disturbance at night.

Relief after urination not perfect and desire soon returns.

In some cases slight burning pain on urination and in severe cases tenesmus.

Either slow small stream or spasmodic urination with great force from contraction of the bladder.

In some cases inability to urinate, or hesitation due to spasmodic contraction of the cut-off muscles.

**Etiology.**—Due to more or less constant condition of irritation of the prostatic sinus in the neighborhood of the seminal ducts without inflammatory lesion.

The chief cause is irregular or ungratified sexual desire, especially in arthritic cases, and where the urine is acid and irritating. It may be aggravated by anything capable of inflicting a structural change in the tissues of the neck or its neighborhood (stricture, abscess, large prostate, rectal diseases, stone, worms, inflammations, etc.).

The disease is more common according to the writer's experience in young unmarried men. It may disappear after marriage.

**Differential Diagnosis.**—Cystitis is differentiated by the presence of pus in the urine which is not found in simple irritability. The two diseases may co-exist; in which case the extreme sensitiveness of the cut-off muscles will detect the cause of the cystitis, as also the history.

Dr. Peyer considers this affection a neurosis. The chief

symptom, vesical tenesmus, appears both during the day and night ; there is a spasmodic state of the sphincter, with spastic enuresis and spastic ischuria, burning on urination, pains in the loins, a sense of pressure in the hypogastrium, cold feet, anaesthesia or hyperaesthesia of the genitals, inability to stand for a time, etc.

In diagnosis, examine the whole patient, his nervous system, thorax, abdomen, kidneys and pelvic organs, and then the bladder. Examine the urine for urethral threads, gonorrhœa, or long-lasting masturbation ; the prepuce for phimosis, balanitis, smegma ; the urethra for irritable or inflamed spots ; sound the urethra ; examine the post-bulbar portion by the rectum. A diagnosis must be made by exclusion. Differentially, one should exclude :

1. *Acute parenchymatous nephritis*, which is recognized by albuminuria, casts, blood- and pus-corpuscles.
2. *Contracted kidney* presents increased or decreased quantity of urine, few or no casts, albuminuria and hypertrophy of the heart.
3. *Pyelitis* has pus and blood in the urine, with pains in the regions of the kidneys.
4. *Chronic pyelitis* causes the urine to be increased nearly double in quantity, so that this sign is almost pathognomonic. The albumin is sometimes greater in quantity than the pyuria would seemingly give rise to.
5. *Diabetes mellitus* and *insipidus*, as well as *retention of urine*, offer no special difficulties.
6. *A contracted bladder* cannot be filled with over 50 to 100 gms. of urine.
7. *Stone in the bladder* has been often operated for without any stone having been found.
8. *Fissures of the neck of the bladder* are not rarely met with in men, and are sometimes due to a former gonorrhœa. There is great pain after urination, and in the last drops of urine are detected white bodies with red blood-corpuscles. The endoscope will confirm the diagnosis.

9. A beginning stricture or one of large calibre may be gradually accompanied by tenesmus vesicæ and a disagreeable burning in the urethra. The sound is here the decisive measure; any one that will pass the meatus should pass through the whole canal, as the meatus is the narrowest portion. In general, where a No. 20 French bougie will not pass, one may safely say that there is a stricture.

The patient can hold his urine better when his mind is occupied, or when under stimulation by liquor.

On rainy, damp or cold days the desire to urinate is greater, and also during worry.

There is depression of spirits, in some cases hypochondriasis.

Unpleasant sensations may be felt in the rectum or perineum.

Nocturnal emissions are frequently complained of, and abnormalities of erection experienced.

Spasmodic urethral stricture may occur.

Functional disturbances of the bowels, often constipation, and feeling of lassitude may be present.

**The Urine.**—This is usually deficient in acidity, abundant in quantity, of light color and somewhat lowered specific gravity, without, as a rule, marked deficiency in totals of the various solids. Amorphous phosphates and calcium oxalate crystals may be found in the sediment.

**Prognosis.**—Good, if the disorder is recognized and treated carefully.

**Treatment.**—The essentials are the following:

Attention to the sexual element; purity of thought and deed; out-of-door exercise, gymnastic exercises regularly performed.

Avoidance of alcoholic beverages and use of tobacco.

Change of habits or occupation, rest from business cares.

In phosphatic cases the treatment of phosphaturia. (See **PHOSPHATURIA.**)

Passage of a moderate-sized steel sound, well-warmed and oiled, and introduced with the utmost gentleness: in young men every second to fourth day; in older men, daily. Not to be used when there is prostatitis or cystitis.

**Symptomatic Treatment.**—*Belladonna*.—Symptoms given under CYSTITIS. Useful in cases where there is congestion of the bladder. Use third decimal.

*Equisetum*.—See CYSTITIS for indications.

*Ferrum*.—In congestive cases with anaemia, and debility.

*Hyoscyamus*.—See CYSTITIS for indications.

*Nux vomica*.—Useful in lithæmic cases.

*Rhus aromatica*.—Use the tincture in ten-drop doses or more.

#### IRRITABILITY OF THE BLADDER IN WOMEN.

**Definition.**—Hyperæsthesia of the trigone without cause other than neurosis. In women there is frequently a localized hyperæmia. (See also below).

**Etiology.**—It is due either to neurosis and hysteria or malaria; lithæmia is also a cause. Reflex causes may exist, as haemorrhoids, uterine and vaginal diseases. (See also below).

**Diagnosis.**—Frequent and painful urination without signs of inflammation in the urine suggests the condition.

**Clinical Features.**—The symptoms are pain and frequency of micturition, marked vesical and rectal tenesmus, and dysuria not relieved by micturition. There may also be spasm of the bladder and inability to void urine.

**Differential Diagnosis.**—Absence of mucus and pus in the urine, the clearness of the urine, and the neurotic history distinguish the disease from cystitis.

**Prognosis.**—Good. The disease is not fatal, but recovery may be slow unless some of the surgical measures later described are instituted.

**Treatment.**—Removal of any reflex cause. Moral suasion, suggestion, etc., in nervous cases. Observance of regular habits. Rest and feeding for neurasthenic patients. Treatment for lithæmia, if it exist. Use of diluent drinks freely. Administration of nerve sedatives and urinary antiseptics. (Eichhorst.)

Cases certainly appear to occur in which no local lesion is demonstrable, but the use of the cystoscope in skilled hands has of late shown that in the majority of instances the condition is not a neurosis, but dependent on some recognizable local condition. In 176 cases studied by Bierhoff there was in no case a pure neurosis. The abnormal conditions found by him were the following:

	<i>Old Series</i>	<i>New</i>	<i>Total.</i>
Urethritis, . . . . .	—	3	3
Urethrocytis (sphincteral inflammation) —	5	5	
Sphincteral papillomata, . . . . .	—	15	15
Vesical hyperæmia, . . . . .	14	57	71
Vesical varices, . . . . .	5	7	12
Catarrhal cystitis, . . . . .	27	23	50
Prolapse of anterior vaginal wall (not to the extent of cystocele), . . . . .	—	3	3
Cystocele, . . . . .	4	2	6
Bacteriuria, . . . . .	—	1	1
Vesical tuberculosis, . . . . .	1	—	1
Pericytitis, . . . . .	27	48	75
Carcinoma (extravesical), . . . . .	3	—	3
Pregnancy, . . . . .	5	9	14
Malpositions of the uterus, . . . . .	10	43	53
Inflammatory conditions of the uterus, or adnexa, or both, . . . . .	—	23	23
Pelvic inflammations, acute (alone or as accompanying conditions), . . . . .	—	2	2
Pelvic inflammations, chronic, . . . . .	—	24	24
Tumors { uterine, . . . . .	—	2	2
{ pelvic, . . . . .	—	2	2
Movable kidney, . . . . .	—	1	1
Nervous conditions (as accompanying causes), . . . . .	4	5	9

In cases in which vesical hyperæsthesia exists it does so

only as a symptom ; in the majority of cases as a direct result of some change in the vesical mucous membrane, in the minority as an indirect result of changes in other organs adjoining or near the bladder.

The diagnosis of the causative factor must rest upon a thorough examination not only of the bladder, but also of the urethra and the genital and pelvic organs as well.

The treatment must be directed both against the local changes and the causative factors of these.

The principal points in the diagnosis are the following :

*Urethritis*.—Examine pus for presence of gonococcus, or locate areas of inflammation, fissures, condylomata, etc., by use of the endoscope.

*Urethrocystitis* (catarrhal).—In this condition there is usually a more marked degree of tenesmus than of pollakiuria. The urine is clear and of normal composition. The cystoscope reveals the redness and swelling of a degree of severity varying with the intensity of the process. This change is, however, one which affects the *sphincteral margin* exclusively or chiefly. The mucous membrane at the sphincter and just beyond, on both the vesical and urethral sides, is found congested and swollen, sometimes markedly so. The surface is angry-red and irregular, especially over the lower median portion. The rest of the bladder is free of inflammation ; the urethra, however, may also be the seat of a catarrhal inflammatory change. A feature of this condition is the exquisite tenesmus it frequently calls forth.

*Hyperæmia*.—This condition possesses certain points which distinguish it from true cystitis, viz., while in cystitis of either the suppurative or catarrhal type we see a surface somewhat roughened, and of an even, deep-red color, all contours of the individual vessels being lost, in hyperæmia we can readily distinguish that the redness is caused by an abnormality of the capillaries, which appear to be increased in number and dilated. The individual vessels are, however, still recogniz-

able, whilst between them are distinguishable small areas or islets of normal, yellowish mucous membrane. Zuckerkandl considers local hyperæmia a cause of vesical hyperæsthesia and mentions the increased liability to cystitis resulting therefrom. Kelly states that he finds it in all those cases hitherto diagnosed as "irritable bladder." The condition is due either to direct irritation of the mucous membrane, to the extension to the bladder of urethral, congestive processes, or it is secondary to pelvic congestions, or to pressure of other organs or tumor-masses.

*Catarrhal Cystitis.*—See also *Hyperæmia*. The inflammation is chiefly in the trigone. The surface looks satiny. The inflammation may also be present over portions of the bladder wall, outside of the trigone, in discrete or confluent patches. The urine remains clear or contains only *isolated* leucocytes, epithelium, bacteria, etc. In certain cases the roughening of the surface is found to be due to minute papillary growths; in others small transparent blebs or vesicles are found.

*Vesical Tuberculosis.*—Bierhoff describes the cystoscopic appearances in two cases as follows: Two cases have come under observation, one presenting the symptoms of only vesical hyperæsthesia, the other of a severe, suppurative cystitis. Both occurred in females. In the former case, which also presented signs of advanced pulmonary tuberculosis, the cystoscope revealed a normal bladder wall, with the exception of a large shallow ulceration, with clean-cut edges of somewhat irregular outline, on the lower left posterior wall. It rose from an apparently normal base, was surrounded by a narrow margin of inflammation, and its surface was covered with a yellowish-gray coating. The second case also occurred in a patient with pulmonary tuberculosis, though not very advanced. The history of the acute attack covered only a period of six to seven weeks, although there had been slighter trouble with urination at intervals over an indefinite period prior to this. The cystoscope revealed a diffuse cystitis affecting the

trigone. At different points over the bladder-wall were distinct ecchymoses, surrounded by apparently healthy walls. Both ureteral orifices (notably the right) were swollen and inflamed. On the upper left lateral wall were three small superficial ulcerations, discrete, with clean-cut edges, rising from an apparently healthy mucous membrane, and surrounded by a narrow zone of inflammation. They were covered with a yellowish-gray coating. Catheterization of the ureters revealed a considerable quantity of pus in the urine from the right kidney, a small amount in that from the left.

The first case he regards as primary, the second secondary, to renal tuberculosis.

*Pregnancy.*—This may cause vesical hyperesthesia, either as a direct result of pressure upon the bladder by the distended uterus, or as a result of the vesical hyperæmia, varices, etc., which it may bring about through interference with the pelvic circulation (Peyer, Fritsch, Zuckerkandl, Viertel, Casper). These conditions may occur in the earlier months of pregnancy and become more pronounced if the distensibility of the bladder is interfered with by pericystitic strands, or adhesions. The cystoscope reveals a rounded tumor, covered with normal mucous membrane, protruding into the bladder. Close inspection shows it to be marked with rounded long irregularities, in all probability the fiber bundles of the uterine muscle seen through the bladder-wall. Another condition seen at times during pregnancy is a decided prominence (both in depth of coloration and in extent of development) of the venous plexuses of the vesical wall. These may, at times, especially if there is cardiac insufficiency, become pronouncedly varicose.

The prognosis of vesical hyperesthesia is good. It is not, of itself, a serious condition, but may prove a very favorable foundation for graver conditions of the urinary organs. The cases due to local inflammatory changes are most readily and quickly cured. In the presence of extravesical causes, how-

ever, the course of the disease is slower and more tedious, and may extend over months, or even years; if neglected, it may lead on to incurable exstrophy of the bladder.

His methods of treatment are as follows;

*Urethritis*.—Treat the cause, as *e. g.*, gonorrhœa, fissures, condylomata, areas of inflammation, etc.

*Urethrocystitis*.—Application of Nitrate of Silver, 0.5 per cent. to 2 per cent.

*Papillomata*.—Cautery, strong caustics, or the snare.

*Hyperæmia*.—Removal of extravesical pressure-causes; subsequently irrigations of one per cent. Boric Acid alone or followed by instillations of 0.25 to 0.50 per cent. Silver Nitrate.

*Varices*.—Removal of any obstruction to the venous circulation; bladder washing with a large catheter, if there are haemorrhages; as a hemostatic, solutions of Antipyrin or Ferripyryn; severe bleeding may require actual cautery.

*Catarrhal Cystitis*.—Vesical irrigations with one per cent. Boric Acid, followed by instillation or injection of 0.25 per cent. to 2 per cent. Silver Nitrate, with Urotropin internally.

*Cystocele*.—Gynæcologic treatment.

*Bacteriuria*.—In bacteriuria the urine is turbid, and upon examination the turbidity is found to be due entirely to bacteria. *Bacterium coli* is most frequently the germ found in this condition. The internal use of Urotropin alone, as described before, or alternated with Salol, in conjunction with the regulation of the bowels, and with bladder-irrigation with one per cent. Boric Acid solution, followed by one-tenth per cent. to one-fourth per cent. Nitrate of Silver solution, usually gives the best and speediest results.

*Vesical Tuberculosis*.—Treatment should, first of all, be directed to the general condition. Local treatment consists of measures varying from injections of Nitrate of Silver solution to Iodoform emulsion, to curettage, cauterization or excision.

*Pericystitis*.—Treatment consists of a gradual stretching of

the perivesical strands, by means of a gradual, progressive distention of the bladder with fluid. Tepid Boric Acid solution is slowly and gently injected to the point of tolerance, and allowed to remain a few minutes. The procedure is repeated at daily intervals, if possible, the quantity of fluid being gradually increased.

*Carcinoma*.—Simple irrigations at times afford relief.

*Pregnancy*.—If no inflammatory reaction is present, no treatment is needed. When it is present, however, benefit is obtained from irrigations, followed by the application of Nitrate of Silver solution, of one-tenth per cent. to one-half per cent., through the endoscopic tube to the trigone and sphincter. In cases in which there is a tendency to abort, irrigations alone should be employed.

*Malposition of the Uterus*.—Treatment gynæcologic.

*Inflammatory Conditions of the Uterus, or Adnexa, or Both*.—These may exert an influence through the extension of inflammation to the bladder by bringing about congestion affecting this viscus, or by limiting its distensibility. Treatment of the bladder is unnecessary; it should be directed toward the original condition, since the vesical hyperæsthesia usually disappears with the subsidence of the inflammation.

*Pelvic Inflammations (acute)*.—These act similarly to the preceding.

*Pelvic Inflammations (chronic)*.—These act, as does pericytis, chiefly mechanically, through limiting the distensibility of the bladder.

*Tumors (pelvic and uterine)*.—These become factors in the causation of vesical hyperæsthesia, either because of their direct pressure upon the bladder or by bringing about congestion of the vesical mucous membrane through interference with the pelvic circulation. They are only recognizable with the cystoscope when they press directly upon the bladder. Then they present a protrusion, of rounded contour, into the vesical cavity.

*Movable Kidney.*—The extent to which a movable kidney may act as a factor in the production of pollakiuria has not been decided.

*Nervous Conditions.*—The nervous conditions we have had have been neurasthenia, hysteria, ataxia and epilepsy. These neurasthenia occurs most frequently and is of the greatest importance as a contributory cause. It stands to reason that, if the nervous system is weakened, conditions which otherwise would perhaps pass unnoticed may produce many symptoms. Then, again, allowance must also be made for the natural tendency to exaggerate symptoms or conditions which is present in those suffering from nervous conditions. Coincident with the treatment of whatever vesical or travesical changes may be present must be that of the nervous disease.

#### PARALYSIS OF THE BLADDER.

**Synonym.**—Cystoplegia.

**Definition.**—Loss of power of contraction.

In cases of paralysis the bladder loses its power of contraction, becomes distended with retained urine, and incontinence of urine results.

**Etiology.**—The causes are lesions of the spinal cord, distension or prolonged compression. A frequent cause of the latter is the pregnant uterus.

Inflammations of the bladder, carcinoma, and nervous, hysterical or hypochondriacal conditions are common clinical causes. Debility from masturbation and senile marasmus are also causes.

Diseases of the spinal cord in which it occurs are mainly the following: Myelitis, tabes, multiple sclerosis and spinal concussion. It is sometimes noticed in cases of swelling of the brain and in opium poisoning.

It may occur after excessive distension from any cause.

in cases of alcoholic intoxication, and is common in the case of persons who on account of occupation are obliged to retain their urine for long periods of time. It may be due to stricture or prostatic hypertrophy.

**Diagnosis.**—Inability to void urine without pain and the presence of residual urine suggest this disorder.

**Clinical Features.**—Two kinds of paralysis are observed, that of the detrusor and that of the sphincter, or simultaneous paralysis of both.

In paralysis of the detrusor we find difficulty in voiding urine and great straining; in paralysis of the sphincter dribbling and incontinence of urine.

A combination of the above symptoms occur when both sphincter and detrusor are paralyzed.

#### MOTOR NEUROSES.

The motor neuroses of the urinary system are either spasmodic contractions or paralysis. *Dribbling of urine* after micturition is probably due to spasmodic contraction of the organic muscular fibres of the urethra throughout its whole length. Spasm of the external sphincter shows itself by more or less inability on part of the patient to urinate, though the impulse is frequent. The treatment is the daily passing of large metallic sounds, allowed to remain in from five to fifteen minutes.

Spasm of detrusors (*cystospasmus*) is shown by a frequent, though generally painless, impulse to urinate, for the most part only by day, but also during any sleepless nights. The urine is clear, pale, of low specific gravity, neutral or faintly acid, or even alkaline, and increased in quantity. The phosphates appear on heating. If the disorder is the result of gonorrhœa, we find short, thick shreds from the prostatic urethra. The treatment is to decrease mental work, prohibit sexual excesses, advise change of air, travel, sea bathing,

agreeable recreation, etc. Internally, *China*, *Ferrum*, *Arsenicum*, in the lower pecimals. In severe tenesmus, Morphine suppositories. If due to gonorrhœa, sexual excess or masturbation, then passage of sounds, use of short urethral catheter, warm rectal injections and warm baths.

*Paralysis of the bladder* is shown by inability to empty the bladder completely. The diagnosis is made by passing catheter immediately after patient has urinated. The amount of urine then drawn off is a measure of the insufficiency of the bladder. Moreover, patients complain that they have to wait long before urinating, pressing and straining; when the urine comes, it falls feebly down. There is no feeling of satisfaction after urinating. If the paresis pass gradually into paralysis incontinence occurs, first at night, but later becomes constant. The diagnosis between paresis of the sphincter and of the detrusor is made, according to Ultzmann, as follows:

PARALYSIS OF THE SPHINCTER.

Incontinence of urine, early and in the day first.  
No retention.  
No distention.  
No dulness over symphysis.  
No resistance to catheter.

PARALYSIS OF THE DRETRUSOR.

Incontinence late and in the night first.  
Retention possible.  
Bladder distended.  
Several finger-breadths of dulness over symphysis.  
Powerful resistance.

**The Urine.**—In paralysis of the bladder the urine may be normal or neutral, or feebly alkaline, with a sediment of earthy phosphates. Diabetes decipiens is sometimes an accompaniment. Gradually a purulent bladder catarrh comes about.

The treatment of paralysis is as follows: In light cases when in strong persons slow and infrequent micturition is established, daily massage of the bladder, regular micturition at short intervals and with use of mineral waters containing salts of soda, as Carlsbad; regular exercise with cold rubbing

of entire body, cold sitz-baths, douching of the perinæum and over the bladder and lumbar region, cold showers on the back immediately after coming out of a hot bath. [Internally, Ultzmann advised Quinine, Ergot, Strychnine. The latter hypodermically,  $\frac{1}{60}$  of a gramme of Strychnine nitrate in 10 c.c. of distilled water, one-half to a whole Pravaz syringeful daily, injected into the skin of the abdomen over the bladder; to be discontinued if muscular twitching, etc., appear.]

A thoroughly carried out regular course of catheterization with vulcanized rubber catheters is advised by Ultzmann. After some weeks or months of catheterization electricity may be used, one pole as a catheter-formed electrode being passed into the bladder, and the other placed over the lumbar vertebræ, or introduced into the rectum. Electricity should not be used too early nor at all if there is purulent pyelitis or nephritis.

In paresis of the sphincter, or when this predominates, the electrode need be passed only into the prostatic urethra.

*For dribbling of the urine* faradic applications every day or every other day. Let the patient sit on a wet sponge connected with one pole of the battery and place the other over the pubes. Use a pleasant current and reverse several times during the treatment. Also apply the negative to the spine, especially the lumbar region, positive at the base of the spine. Treatments may last from fifteen to twenty minutes.

#### SPASM OF THE BLADDER.

**Synonym.**—Cystospasm.

**Etiology.**—It may be due to various diseases of the bladder or be purely of nervous origin in hysterical, hypochondriacal or neurotic patients; it is also observed in masturbators. In rare cases it is reflex from diseases of the uterus or ovaries, or may be due to worms. It may follow the drinking of young wine or beer, or the eating of asparagus. (Eichhorst.).

**Clinical Features.**—Two kinds of spasm are noticed, spasm of the detrusor and of the sphincter. The former is characterized by a periodically-occurring abnormal desire to urinate, even if the amount of urine be small. The latter evidences itself either by the passage of urine drop by drop or complete retention, together with intense pain in urinating, which may radiate to the anus, testicles and glans penis.

The spasm may simultaneously involve both detrusor and sphincter, in which case we find an abnormal desire to urinate, with obstruction to the flow and pain on voiding urine. The patient is pale, faint and bathed in perspiration.

**Differential Diagnosis.**—The disorder is distinguished from cystitis by the absence of changes in the urine.

**Treatment.**—This consists in hot applications to the bladder and the use of warm baths (99.5° F.). The patient should be advised to try to urinate while in the warm bath. For the pain morphine suppositories in the rectum may be used.

*Retention of urine* in paralysis or spasm calls for hot baths, copious rectal enemas, and symptomatic treatment with such remedies as Gelsemium, Ignatia, Moschus, Hyoscyamus, Zincum, Pulsatilla, Caulophyllum, Asafœtida. Irrigation of the urethra with warm Boric acid solution, and a rectal suppository of Opium, one-half grain, and Belladonna, one-quarter, are advised by Carleton. If these fail the catheter must be used.

**Circulatory Disturbances.**—These are (1) active and passive hyperæmia and (2) haemorrhage.

*Active hyperæmia* is due to the presence of irritant substances in the urine, but is usually not recognizable until after death. It is occasionally seen in the bladder of women who have died from septic infection.

*Passive hyperæmia* is the result of pressure on the vena cava, as by tumors or the pregnant uterus, and in time may lead to varicosis of the bladder and haemorrhage.

*Haemorrhages* are most commonly due to calculus or

tumors. Bladder tumors, even though small, may bleed profusely, causing profound anaemia and death. Haemorrhages may also be due to inflammation, passive congestion, varicosis, trauma and the haemorrhagic diathesis.

In cases of hyperæmia of the bladder local applications of Nitrate of Silver and of Glycerite of Tannin and Ichthyol; the fine coil of the Faradic current; absolute rest and mild diet; correction of any abnormal condition of the urine; perfect drainage and rest for the bladder by means of an artificial vesico-vaginal fistula are now advised.

*Vesical haemorrhoids* may be recognized by the cystoscope. Haemorrhage from no obvious cause may be due to them. A few fatal cases have been chronicled. The treatment consists in giving Hamamelis, tincture, internally in one-drachm doses three times daily, together with irrigation of one per cent. Tannic acid solution and one-half per cent. Alum solution, alternated with a three per cent. Boric acid solution or a one per cent. Salicylic acid solution.

*Retention of urine* from obstruction of the urethra by blood clots is usually overcome by waiting until the urine becomes ammoniacal and dissolves the clots. If this is impossible catheterization or supra-pubic cystotomy is necessary. If the catheter cannot be introduced, aspiration of the bladder may be successfully used if with aseptic precautions.

*Amyloid degeneration*.—This is rare and usually a part of general amyloid disease; occasionally it may result from chronic inflammation.

## CYSTITIS.

**Synonym.**—Inflammation of the bladder.

**Definition.**—Inflammation of the mucous membrane of the bladder.

**NOTE.**—In order to understand much that follows, reference should be made from time to time to Figures 26, 29, 32, 33,

34, 36 and 37, in which the anatomy of the parts is brought out.

**Etiology.**—The disease is due to bacteria, but, as is frequently the case in bacterial diseases, there are a number of factors which favor the action of micro-organisms; these are retention of urine and all conditions favoring stasis, injury, stone, exposure to cold, irritant qualities of the urine, and lesions of the spinal cord.

Commonly cystitis is due to the *Bacillus coli communis*, which, however, is incapable of producing cystitis in the absence of the predisposing factors.

The *Proteus vulgaris*, by virtue of its ability to cause decomposition of the urine, may cause cystitis. It is possible that the gonococcus, the typhoid bacillus, and the thrush-fungus may also produce it. Slight degrees of cystitis are found in infectious diseases, especially typhoid fever, influenza, mumps, scarlet fever, and others in which a slight degree of acute nephritis exists. Probably due to local action of bacteria or toxines concerned in the origin or progress of the primary disorder. Cystitis is frequently associated with gout, and is explained as a result of a direct irritation of the mucous membrane by the concentrated urine.

It may be due to injuries from instruments, injections, pressure of faeces or of pessaries, or the foetal head; foreign bodies, as calculi and bacteria, especially the gonococcus; irritating substances taken internally may produce cystitis, as Cantharides, Copaiba, Cubebs, or even Mustard; retention of urine from whatever causes; extension of inflammation from neighboring parts, especially when an unclean catheter is used.

It is associated with flexions of the uterus, constipation, and may occur after suppression of urine.

It may be due to masturbation, excessive venery and haemorrhoids.

Clinically we find cystitis most common following gonor-

rhœa in young men, the result of stone or enlarged prostate and retention of urine in old men, and in women as a result of childbirth or extension of inflammation from the vagina or rectum. In diseases of the spinal cord cystitis from retention is common.

In other words, cystitis is essentially a secondary disorder.

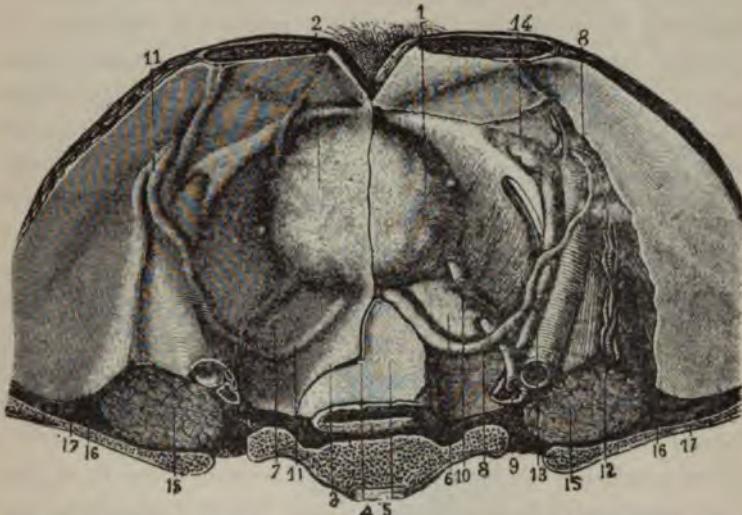


FIG. 26.—Relations of the posterior and inferior regions of the bladder in man. 1, right half of posterior surface of bladder; 2, left half covered with peritoneum; 3, semi-circular fold which this membrane forms when empty; 4, median section of this fold; 5, right seminal vesicle; 8, seminal duct; 9, ureter; 11, 11, left ureter, covered with peritoneum; 12, spermatic vein and artery; 15, external iliac artery and vein.—(SAPPEY.)

**Pathologic Anatomy.**—Cystitis may be either catarrhal, phlegmonous or interstitial, diphtheritic or pseudo-membranous, and gangrenous.

*Catarrhal cystitis* may be either acute or chronic. Acute catarrhal cystitis is marked by red, swollen mucous membrane, and slimy bladder contents; purulent contents mark a suppurative condition.

In severe cases haemorrhages and superficial ulceration may occur. The trigone, and urethral and ureteral orifices are the favorite seats for the changes.

The bladder is usually empty and contracted after death, and in some cases there is little alteration of the mucous membrane other than more or less edema.

*Chronic catarrhal cystitis* is marked by blue slate-colored spots in the mucous membrane, and slimy rather than purulent contents.

There is usually hypertrophy of the bladder-wall, especially involving the muscular coat, and the interior of the organ has a ribbed or trabeculated appearance. The veins are prominent, and the mucous membrane has a yellowish appearance and is covered by shreds of mucus and urinary salts, especially in the depressions between the trabeculae. If the cystitis is due to spinal disease with paralysis, the bladder-wall may be thin and stretched.

*Pseudo-membranous cystitis* is marked by the presence either of fibrinous clots, or more frequently by ecchymoses, ulcerations and superficial necrosis, the latter appearing as opaque-gray or yellow patches, sometimes containing urinary salts, which are especially prominent at the neck and on projecting folds of the mucous membrane.

The condition is at times found in women after labor, but more commonly occurs in cases where there is advanced ammoniacal decomposition of the urine, especially in connection with nervous paralysis of the bladder. In severe cases there is an extensive exfoliation of the mucous membrane.

*Phlegmonous cystitis* is characterized by destruction of the submucous layer and detachment in shreds or flakes of the mucous membrane, or exfoliation of the same as a cast.

It occurs in chronic cystitis, especially when due to retention of urine from stricture or from enlarged prostate; the submucous layer may become, in the course of these diseases, the seat of a purulent infiltration, causing a bulging into the bladder with eventually perforation. If the latter is internal an ulcer develops; if external, diffuse cellulitis (para-cystitis), is produced.

*Gangrenous cystitis* occurs most commonly in the cystitis accompanying paralysis of the bladder; it is also found in acute septic conditions, severe injuries, and malignant tumors. The favorite seat of the process is the trigone, which is covered by a greenish slough surrounded by an intensely injected mucous membrane. Perforation occurs in this form of cystitis.

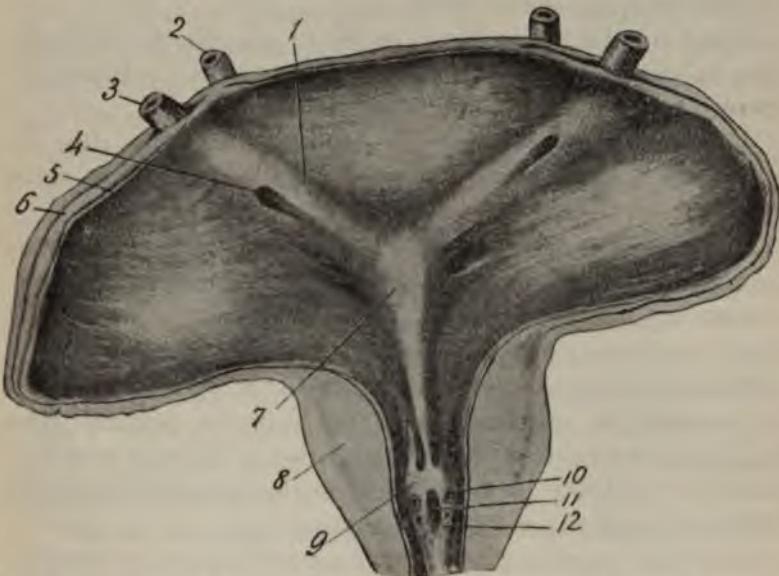


FIG. 27.—Lower part of the male bladder, with the beginning of the urethra. Exposed by incising the anterior wall and laying it open. 3, ureter; 4, opening of the ureter; 2, vas deferens; 9, colliculus seminalis; 7, Bell's muscle; 8, section of prostate; 10, orifice of the common ejaculatory duct; 11, opening of utricle; 12, mouths of prostatic glands; 1, Mercier's band.—(HENLE.)

In addition to the above forms we find *variolous cystitis* in small-pox, characterized by a specific eruption on the mucous membrane of the bladder and possibly also a *true diphtheria of the bladder*. A rare form of cystitis known as *cystitis granularis* is known, characterized by the presence of small nodules in the mucous membrane, especially in the region of the neck. The nodules are composed of highly vascular lymphoid tissue.

Cystitis due to presence of cysts is also known to occur.

**Diagnosis.**—Cloudy urine voided with frequency and pain suggests cystitis.

**Clinical Features.**—In acute cystitis we notice the following features :

Pain in the bladder.

Tenesmus.

The condition of the urine.

The pain and tenesmus are probably referable to inflammation in the neck of the bladder and, in women, to inflammation of the urethra accompanying the disorder.

*The tenesmus* is even more severe and distressing than the pain, and may amount to strangury, with micturition every few minutes and passage of blood at the close of it.

*The pain* is usually referred to the region of the symphysis pubis, but may extend to the perinæum and rectum ; is early, distressing and persistent. May be preceded by a chill and fever, the latter lasting for some little time. There may be a sense of weight and an aching feeling in the perinæum, which is increased by accumulation of fæces in the rectum. The pain is somewhat relieved by micturition. There is usually a heavy or markedly painful feeling in the hypogastric region, which is greatly increased by pressure.

In *chronic cystitis* pain and tenesmus is not so noticeable, but the obstruction to the flow of urine and constant fermentation of urine result in frequent and difficult urinations, extending over a period of weeks or months, with backache, headache, leg-ache, and a whole line of symptoms more or less distressing, including constipation, alternating with diarrhoea.

Chronic cases are serious where paralysis of the sphincter of the bladder occurs. Owing to involuntary micturition the patient's clothing becomes saturated with urine and the odor is noticeable to one entering the room where the patient is. In eccentric hypertrophy the bladder can be felt above the pubes and is never empty. In concentric hypertrophy it is

felt as a hard globular body by the finger in the rectum or vagina.

**The Urine.**—The feature is the *cloudiness* of the freshly-voided urine, due to particles of slime, leucocytes, epithelia, numerous micro-organisms and some few blood-corpuscles. The *color* in acute cases is darker than normal, the quantity not being increased, but rather diminished. In chronic cases the color is often lighter than normal. The *reaction* in acute cases is acid, in chronic cases usually alkaline. In some few cases of long-standing cystitis in old men with enlarged prostate the urine remains persistently acid.

It is a mistake to think that the urine must be alkaline in cystitis; in some cases of mucous cystitis the reaction may even be hyper-acid.

*The sediment* contains numerous polynuclear leucocytes, large, round epithelia from the middle layers of the bladder, occasional blood-corpuscles, and numerous micro-organisms in the acute cases. In chronic cases with alkaline urine we find the usual phosphatic sediment and ammonium-urate crystals. (See writer's URINARY ANALYSIS, pages 262, 274, 278.) The micro-organisms in chronic cystitis are usually pathogenic bacteria. (URINARY ANALYSIS, page 323.)

The pus in chronic cases is sticky, in acute cases flocculent. The pus-corpuscles in chronic cases are partially destroyed by the alkaline urine, so that much granular *débris* is found, and those corpuscles which remain may be ill-defined and indistinctly seen.

Heitzmann located the seat of the inflammation by observation of the size of the epithelia from the middle layers, the large ones coming from the region of the neck.

*The urinary solids* are usually somewhat diminished in total amount.

*Albumin* is present in considerable amounts in acute post-gonorrhœal cystitis involving only the vesical neck—sometimes enough to settle to mark 1 on the Esbach tube. Such

quantity of albumin makes showing enough, when the urine is boiled, to alarm both physician and patient. In other cases but a trace of albumin is found, especially in chronic cystitis. Nucleo-albumin (mucin) reaction is prominent in these cases.

*The odor* is strongly acrid in the acute cases, but not ammoniacal when freshly voided. On standing, however, the ammonia odor is soon perceived.

In chronic cases an acrid odor is also common, but in the more severe cases an ammoniacal odor is noticed. In the ulcerative cases a particularly foul odor is present.

There may be a foecal odor in purulent cases due to penetration of the bladder by gas from the bowels; an odor of sulphuretted hydrogen may also be noticed (hydrothionuria); and in diabetic cystitis gas may be passed from the bladder (pneumaturia).

In chronic cases the urine becomes more and more cloudy, although perhaps lighter colored; the pus increases, and sometimes also the albumin. The pus becomes sticky, owing to the alkalinity of the urine.

The amount of albumin is variable and, while it seems, as a rule, to bear relation to the amount of pus present, sometimes we find but a trace of albumin where there is much pus and at other times more albumin than the small bulk of pus would appear to account for.

The writer finds that a sediment of pus-corpuscles which measures  $1\frac{1}{2}$  per cent., when sedimented for five minutes at a speed of 1000 revolutions, may be found in urine which yields no measurable quantity of albumin with the ferrocyanic test-liquid.

If, on boiling the urine, a moderate precipitate of albumin, one-twentieth to one-twenty-fifth of the volume of the urine, is formed, its exclusive origin from pus is to be inferred, if several pus-corpuscles are found by the microscope in each drop of the shaken urine.

**Differential Diagnosis.**—Cystitis may be differentiated from pyelitis by the vesical pain, tenesmus, and the character of the urine. Presence of casts, together with a larger amount of albumin than pus or a small quantity of blood will account for, suggests renal complication.

**Differential Diagnosis in Pyuria.**—In doubtful cases there are several methods which may be of service. The writer has found that washing out the bladder before the urine for examination is voided often makes it possible to find tube casts, which, when much pus is present, may escape notice.

Thompson's method of deciding whether pus comes from the kidneys or bladder is the following :

Take a clean, soft rubber catheter, a piece of three-sixteenths-inch rubber tubing, a two and one-half inch glass funnel and a two-inch piece of glass tubing. Into one end of the rubber tubing insert the stem of the funnel, and in the other end the glass tubing. The glass tubing must be drawn down small enough to insert in the distal end of the catheter. Now pass the catheter into the bladder (noting the point at which the passing is painful), and draw off the urine. Insert the glass tubing into the end of the catheter. Raise the funnel to sufficient height so that there is force enough for liquid to run freely into the bladder. Pour in very carefully a warm solution of Boracic acid, then lower the funnel, and let it act as a siphon to draw the solution out again. Repeat this until the washings are clean. If more than two ounces can be borne without much distress, there is no objection to using three or four ounces at a washing. Now let the apparatus remain *in situ* for ten or fifteen minutes (raising the funnel), then draw off the urine which has descended from the kidneys, and set it aside for examination. Now repeat the process of washing. If the first washing is fairly clean, it is reasonable to say that the pus comes from the kidneys or ureters. If, however, a single washing does not cleanse the bladder, it is reasonable to say that the pus is from the bladder.

Ureteral catheterization will not only decide whether the pus is from the kidneys or bladder, but, if from the kidneys, whether from one or both. The instrument known as the segregator, originally devised by Harris, of Chicago, is also useful for this purpose.

**Course and Effects.**—In *acute cystitis*, if a mild form is present, the fever subsides in a few days, the pain and tenesmus gradually disappear, and the urine becomes normal in from eight to ten days.

Severe forms of acute cystitis show greater febrile disturbance, more irregular course, and frequent wide daily variations between the extremes. The severity of the symptoms may be due to complicating pyelonephritis. Cerebral symptoms (delirium, somnolence, stupor) may appear.

Abscess may form, symptoms of which are localized induration, pain, and tenderness shown by rectal examination. If the severe symptoms continue the patient may collapse, temperature become sub-normal and pulse imperceptible.

Prevesical inflammation in the space defined by Retzius may be in part a result of cystitis, and is shown by a sharply defined, usually symmetrical tumor above the symphysis, terminating in suppuration, though sometimes undergoing resolution.

In abscess formation sloughs of mucous membrane may plug the urethra.

The severer forms of acute cystitis or acute exacerbations of chronic cystitis represents usually (*a*) diphtheritic or gangrenous inflammation of the mucous membrane, or (*b*) extension of the inflammation to the subperitoneal and paracystic fibrous tissue.

In *chronic cystitis* pain and tenesmus may be comparatively slight, but the urine grows more and more cloudy, the sediment contains more pus, while albumin increases. The pus becomes sticky from the action of the alkaline urine and forms a gelatinous mass, which can be removed from the

vessel only with difficulty. The digestion becomes more or less impaired, and there is slight loss of flesh and strength.

In time cystitis leads to hypertrophy of the bladder-wall, unless the viscus is permanently distended. The infection frequently ascends, as has already been described, causing pyelitis and pyelonephritis, occasionally ureteritis; or it may extend to surrounding tissues, causing *pericystitis* if the peritonæum is affected, or *paracystitis* if the connective tissue about the bladder.

*Ulceration* may occur in the course of severe cystitis; also in other conditions, as calculus, tuberculosis, and injury from pressure by the child's head during labor, resulting in vesico-vaginal fistula.

*Cholesteatoma* may occur, especially in calculous cystitis.

**Prognosis.**—Depends on the length of continuance of the disorder. In long-continued chronic cystitis the prognosis is undoubtedly unfavorable from danger of extension to the kidney or to the neighboring fibrous tissue. When abscesses form there is danger of peritonitis from extension toward the peritonæum. If the abscess evacuates into the bladder, there is relief to the pain and discomfort.

#### TREATMENT OF CYSTITIS.

**Prophylaxis.**—The essentials of prophylaxis are the following :

1. The patient should avoid exposure of the abdomen when the body is heated.
  2. Instruments, as catheters, to be passed into the bladder should be thoroughly sterilized.
  3. Urethritis, if it occurs, should be thoroughly treated.
  4. Caution should be observed in the internal administration of cantharides, balsams and other irritants. (Eichhorst.)
- Hygiene and Various Palliative Measures.**—In acute *cystitis* rest in bed, with elevation of the pelvis, is helpful. Administration of teas made of hops or linseed is advised.

Hot applications (as an ear of corn which has been boiled) to the perinæum, warm sitz-baths, fomentations of hot water, and hot water enemata sometimes do good.

Warmth of clothing and of climate are essential, the latter especially in chronic cystitis.

Constipation should be overcome by massage of the colon, oatmeal at breakfast, hot water enemata, or Rubinat water.

In very severe asthenic cases leeching the perinæum will relieve the pain there.

In chronic cystitis the patient should wear an abdominal bandage, should take warm baths ( $99^{\circ}$  F.) for fifteen to thirty minutes, twice to four times weekly, put on warmed clothing after the bath, and rest or sleep in a bed with warmed bed-clothing.

**Diet.**—In *acute cystitis* the patient is to avoid salty and spiced foods, asparagus, pork, lobster, cheese, beans, fried foods, pastry and acid fruits; also beers, champagne, coffee, all acid drinks, and saline mineral waters. May drink lithia waters freely during the day, but in small quantities at a time. A small cup of hot milk at bedtime is useful.

If the symptoms are severe, absolute milk diet should be insisted on.

In chronic cystitis the diet should be nutritious and readily digestible, owing to the tendency to gastric derangement. In acute exacerbations the diet should be as in acute cystitis.

One of the writer's patients with chronic cystitis in locomotor ataxia seemed greatly helped by buttermilk and Stafford mineral water.

**Mineral Waters.**—A large number of mineral waters are recommended in cystitis. Those which are slightly laxative and diuretic seem to suit the patients best, as French Vichy, Geneva Lithia, and Allouez. French Vichy is particularly serviceable in cases in which pus is found in the urine associated with uric acid crystals. A glass may be taken one hour before each meal.

**Medical Treatment.**—In general the measures should be the following :

1. Rest in bed with hips elevated.
2. Use of urinary diluents and demulcents.
3. Anodynes for rectum.
4. Urinary antiseptics internally.
5. Hot hip baths and hot applications.
6. Hot rectal enemata.

The urinary diluents and demulcents which are often of greatest service are fluid extracts of Buchu or Triticum and infusion of flaxseed. Boiled milk with lime water, one tablespoonful of the latter to a glass of milk; weak tea and French Vichy water are also serviceable.

For anodyne a rectal suppository containing one-fourth to one-half a grain of Morphine sulphate with one-half to two grains extract of Belladonna is useful.

**Symptomatic Treatment.**—The following remedies with their indications have been advised in cystitis :

*Apis mel.*—Great irritability of the bladder ; frequent urging, with burning and smarting in the urethra ; urine dark, scanty, bloody ; thirst absent ; after abuse of Cantharides and other irritating drugs. (Use third decimal.)

*Arnica.*—Traumatic inflammation ; urine scanty, with thick brown sediment ; after passage of calculus from the kidney.

*Arsenicum alb.*—Burning pains on beginning to urinate ; bladder distended without desire to urinate ; retention of urine, and the usual constitutional symptoms.

*Aconite.*—Urinary symptoms, with great anxiety, restlessness, dry, hot skin and hard, quick, full pulse. (The first decimal.)

*Belladonna.*—Useful in acute cystitis, with highly sensitive bladder, urethral spasm and dysuria. (The second decimal.)

*Berberis vulg.*—Violent pain, stretching, burning and tearing from kidney to bladder ; cutting, constrictive pain in bladder ; desire to urinate, with burning in the urethra before

and after; all urinary troubles worse on motion, and generally accompanied by pain in the loins and back; to be thought of in ureteritis; bran-like sediment in the urine. (Use tincture.)

*Benzoic acid.*—Irritable bladder, with pain when not urinating; dribbling of urine; incontinence, especially at night; urine hot, dark-red, scanty, acid reaction, with strong odor; ammoniacal, very offensive; muco-purulent and phosphatic sediment; patient pale, languid, with feeling of weakness in the loins.

*Camphora.*—Strangury, discharge in drops; tenesmus of the bladder; retention or slow emission; burning in the bladder and urethra; urine red, thick; inflammation caused by Cantharides, Turpentine, etc.; coldness of the extremities; the urine has a musty odor.

*Cannabis Indica.*—Burning, scalding, stinging in urethra before, during and after urination; contains much mucus; dribbles after stream ceases; must wait before urine flows; after exposure to cold; aching in the kidneys; thick, red urine.

*Cannabis sat.*—Pain in neck of bladder and both kidneys, extending into inguinal glands; urging every few minutes; tenesmus worse after urinating.

*Cantharis.*—Great inflammation, with haematuria; intense burning and cutting pains in the bladder; violent tenesmus; stinging, burning, cutting pains in the urethra; violent ineffectual urging; discharge in drops which feel like hot lead passing through urethra; constant desire to urinate; urine scanty, turbid, bloody, albuminous, containing shreds of mucus. (Use the third decimal.)

*Chimaphila.*—In both acute and chronic cases; violent tenesmus; urine scanty, high-colored, turbid, bloody; abundant stringy sediment passed, with pain before, during and after; great difficulty in commencing to urinate; constipation. (Use the first decimal.)

*Capsicum.*—Spasmodic contraction, with cutting pains in

the neck of the bladder ; burning, biting pain in the urethra after urinating ; scanty, light-colored urine.

• *Coccus cacti*.—Useful in chronic cystitis when the urine contains much uric acid and urates, and there is cutting pain and heaviness in the bladder and constant urging to urinate relieved by the act of urination.

*Conium*.—In drop doses of the tincture, may sometimes relieve severe tenesmus. In the lower potencies for difficulty in voiding the urine or frequent urination at night, with pressing pain and stitches in the neck of the bladder, relieved by sitting, worse on motion.

*Copaiba*.—Burning in neck of bladder and urethra ; urine passed in drops ; frothy, dark yellow, with odor of violets ; useful in acute cystitis, especially gonorrhœal, or in irritability in old women.

*Cubeba*.—Chronic cystitis ; cutting after micturition ; smarting during urination, last drops painful ; urine foamy, bloody, smelling like violets.

*Eucalyptus*.—In chronic cases where the urine has an odor like that of violets and there is urinary fever. (Use first decimal.)

*Gelsemium*.—Frequent urging, with scanty emission and tenesmus ; spasmodic retention ; useful in post-diphtheritic paralysis of the sphincter. (Use the first decimal.)

*Dulcamara*.—Cystitis from exposure to cold and damp, and in chronic cases aggravated by cold, damp weather, and when there is thickening of the muscular coats of the bladder ; urine turbid and whitish, or reddish and burning when voided.

*Erigeron*.—Useful in cases of very painful cystitis, with profuse, bloody, strong-smelling urine, and in cases of vesical calculus ; external parts inflamed and swollen.

*Equisetum*.—Painful urination, with albuminous urine ; extreme and frequent desire to urinate, with severe pain, especially just after the urine is voided ; dysuria during preg-

nancy and confinement ; nocturnal enuresis, weakness of the bladder, dribbling of urine, and pain as from over-distention. (Use first decimal.)

*Hyoscyamus*.—Useful in spasmodic cases ; retention of urine, bladder greatly distended, urine turbid ; mucous, purulent sediment ; great thirst, dry tongue ; subsultus tendinum ; delirium ; hysterical subjects.

*Lycopodium*.—Chronic cases ; calculi ; urine frothy, milky, turbid ; offensive purulent sediment ; terrific pain in the back previous to every urination, with relief as soon as the urine begins to flow ; haematuria ; haemorrhoids ; constipation ; flatulence ; copious, red, sandy deposits ; aching pain.

*Mercurius*.—Pressure and heat in the perineum ; in the rectum ; sudden irresistible desire to urinate ; sweat during urination ; region of the bladder sore ; urine turbid, dark red, contains shreds of mucus. Merc. cor. especially has great tenesmus and bloody urine. (Use third decimal.)

*Nux vomica*.—Painful ineffectual urging to urinate ; discharge in drops with burning and tearing pains ; spasmodic retention of urine ; urine pale, or thick with purulent sediment, or red with brick-dust sediment ; constipation ; haemorrhoids ; after abuse of drugs ; useful in gouty cases. (Use the third decimal.)

*Parcira brava*.—Constant urging, with tenesmus ; violent agonizing pain, especially in the early morning ; urine turbid ; much mucus ; ammoniacal urine.

*Phosphoric acid*.—Constant urging ; urine milky, with bloody, jelly-like pieces of mucus ; decomposes rapidly ; burning in the urethra while urinating.

*Piper methysticum*.—Chronic cases with fetid urine ; stringy gelatinous sediment, very adherent.

*Petrolcum*.—Fœtid urine of reddish-brown color, passed involuntarily.

*Phosphorus*.—Bloody urine, with pain in the region of the kidneys and tension over the region of the bladder.

*Nitric acid.*—Useful in the cystitis of elderly men where, immediately after urinating, there is intense desire to urinate again, with shuddering along the spine, especially at night, with a cutting pain in the abdomen and a cramp-like contractive pain from the kidneys to the bladder.

*Plumbum met.*—Paralysis and atony of the bladder. Tenesmus and difficult urination. Patient lacks sensation to make the will act on the bladder. Urine mixed with blood.

*Polygonum.*—Painful cutting and constriction in bladder continuing long after urinating; pain in sacrum and bladder, not relieved by voiding large quantities of pale urine.

*Populus.*—Urine scanty; much mucous sediment; violent tenesmus; cystitis in elderly persons with severe tenesmus.

*Prunus spin.*—Terrific burning in urethra; bladder is more comfortable when containing urine; scanty urine of brown color.

*Pulsatilla.*—Frequent ineffectual urging with cutting pain at the neck of the bladder and tenesmus; slimy sediment; after exposure to cold.

*Sarsaparilla.*—Chronic cases; severe tenesmus; emissions of white, acrid, turbid, flaky matter and mucus; during micturition air passes from the bladder; white sand in urine; offensive smell of genitals; abdomen distended; pain and cramps in the bladder.

*Senega.*—Vesical catarrh of old people; dark urine, frothy, with mucous shreds, on cooling thick and cloudy; great debility, weak legs, trembling and faintness on walking.

*Sepia.*—Chronic cases; full feeling in bladder, with downward pressure; wants to hold up the abdomen; periodical discharge of mucus, sometimes in plugs; urine thick, slimy, highly offensive; burning and cutting when urinating.

*Sandalwood.*—Deep pain and uneasiness in the perinæum; sensation of a ball rolling in the neck of the bladder; worse on standing, relieved by exercise.

*Thuja.*—Frequent urging to urinate with profuse emission;

the urine is clear when voided, but is cloudy on standing (urates) ; there is brick-dust deposit (uric acid) ; burning in the urethra during and for some time after urinating ; stitch-like pain from the rectum to the bladder and from the bladder to the urethra ; incontinence from paralysis and from retention.

*Sabal serrulata*.—In cases of enlarged prostate with unsatisfactory micturition and intense straining ; patient has to wait for the first drop.

*Stigmata maydis*.—Retention, tenesmus over entire abdomen ; constant desire to urinate, with urine containing mucus, blood and pus.

*Sulphur*.—In obstinate cases, or when none of the preceding remedies prove efficient ; urine mixed with mucus and blood, with burning in the urethra when urinating ; imperative desire to urinate.

*Terebinthina*.—Strangury ; tenesmus ; sensitiveness over the region of the bladder ; burning in the region of the kidneys ; sediment slimy, bloody ; urine retained from atony in old persons of sedentary habits ; congestion of the urinary organs. (Use first decimal.)

*Uva ursi*.—Desire frequent, with burning, cutting pains ; urine high colored, with profuse, tough, mucous sediment ; burning and tearing in region of bladder ; constipation ; painfulness and soreness in the region of the kidneys ; uneasy feeling in the left thigh, with frequent desire to urinate ; pain and soreness in the left groin.

Other remedies may be used as follows :

*Saw palmetto* and *Pulsatilla* when there is chronic cystitis with enlarged and tender prostate.

*Triticum* and *Lycopus* when there is delay and effort in starting the urine in chronic cystitis.

*Berberis* in uric acid cases.

*Benzoic acid* when there is incontinence of urine, especially at night. (Bruce.)

If there is pus in the urine the following is useful :

Benzoic acid,	1 part.
Orange-flower water,	50 parts.
Boiled water,	900 parts.
Sugar,	100 parts.
Take by the glass between meals.	

*Cantharides* and its analogues are standard remedies in cystitis, acute or chronic. For *Cantharides* itself the special indications are as follows: Very painful tenesmus, strangury, with very frequent emissions of small quantities of urine, which burns on being passed. It often contains albumin and blood in very considerable quantities. At other times it may contain considerable pus. In some cases the pains radiate into the kidneys and are associated with suppression of the urine. Useful in the cystitis following gonorrhœa, in that of tuberculosis in the painful period when there is hæmaturia. Begin with caution, using third decimal, or even higher, increasing if necessary until two or three drops of the tincture are given at a dose.

**Palliative Treatment.**—As is usually the case in a disorder in which it is frequently impossible to remove the cause, and in one which is liable to acute exacerbations, we find a great variety of drugs used and palliative measures employed.

For the treatment of *acute cystitis following gonorrhœa* the following may be used :

Give Gelsemium, first decimal, on account of the history, to be followed by, or in alternation with, such remedies as Belladonna, Cantharis, Cannabis sat., Ferrum phos. If there are good indications for any special remedy give it.

Usually agonizing urination is the thing most complained of, and Chimaphila, Stigmata maydis, and Uva ursi have been the most satisfactory remedies. If blood is present Terebinthina or Helonias may help the case.

After the acute stage has passed and the patient has but

little pain on urinating, but complains of the imperative nature of the desire, Petroselinum is certainly of service in a great many cases. With this line of treatment nearly all of these cases get well.

If the pain becomes too great to be borne a few doses of Salol, or the injection into the bladder of a small quantity of a two per cent. solution of Cocaine in a warm saturated solution of Boric acid, rather than any form of Opium, is suggested. (E. M. Bruce.)

*Stigmata maydis* in large doses, often as high as sixty minims of the tincture or fluid extract, has appeared to the writer to be of as much service in cystitis as almost any drug given internally. Combined with lithia in cases where the urine is hyper-acid.

*Uva ursi*.—This drug in form of infusion or in ten to twenty-drop doses of the tincture is much used in cystitis. An infusion of the leaves may be made by adding one tablespoonful to a large glass of water; to be taken three times daily.

*Chimaphila* in ten to twenty-drop doses of the tincture may be used. Dr. C. W. Rose reports the following case of cystitis cured by *Chimaphila*:

The patient, a man of 45 years, tall and weight about 170 or 180, had been in the army, and ordinarily lived a quiet life. Had suffered in younger days from severe case of gonorrhœa, developing into gleet:

"Gave twenty drops of *Chimaphila* tincture three times a day, also ten drops of *Vesicaria* that often, washing the bladder out by aid of Calenduline and Pix-cresol, dissolved in hot water, every night. The first week saw not much, if any, change, except less pain in the bladder; thereafter, however, I had the great pleasure of learning that urine became clearer, that less mucus was discharged. In fourteen days mucus almost gone, no more blood at all. In three weeks patient reported as much better and happy. We now discontinued the

washing of the bladder. I continued internal treatment, gradually reducing dose, when now I have patient on *Cantharis* 3x, evidently getting well."

In cases where there is no urethritis *Cantharidin* is sometimes used instead of *Cantharis*; dissolve one milligramme of Merck's *Cantharidin* in a little alcohol, dilute with distilled water to make 100 c.c. (about three and a half fluidounces), and give a teaspoonful three times daily.

*Hydrangea* is a useful remedy in cases where there is severe strangury. It may be alternated with corn-silk or combined with lithia.

*Thuja* may be of use in controlling spasm of the bladder, given in doses of five drops of the tincture every three hours.

*Cannabis Indica* is especially useful for controlling pain in acute cases. Use the tincture.

*Buchu* is given in acute cystitis, either in doses of sixty minims of the fluid extract or combined with *Hyoscyamus* and Potassium bicarbonate in a pill. In cases of severe tenesmus, as in gonorrhœal patients, the following may be employed :

Bromide of Ammonium,	10 parts.
T <small>r.</small> <i>Hyoscyamus</i> ,	5 parts.
Fluid extract <i>Buchu</i> ,	10 parts.
Distilled water,	60 parts.

A coffeeespoonful every four hours.

*Conium* tincture in doses of two drops every hour may be serviceable in relieving tenesmus.

*Pichi*.—For the distressing tenesmus in post-gonorrhœal cystitis this remedy is frequently serviceable. Wyman uses the following :

Extract of <i>Pichi</i> ,	10 parts.
T <small>r.</small> <i>Cannabis Indica</i> ,	2 parts.
Lime water,	90 parts.

A dessertspoonful every four hours.

*Oil of Erigeron*.—This is given for the frequency of urina-

tion occurring in post-gonorrhœal cases; ten drops on sugar may be given every three hours.

*Methylene* (blue) in doses of  $1\frac{1}{2}$  grains in capsules one to three times daily is given in chronic cystitis. The urine becomes blue or greenish within five hours of the initial dose and remains so for several days after the last dose has been given. Toxic symptoms may be caused, and care must be taken to procure a pure article and to begin with small and infrequent doses. If powdered nutmeg be given at the same time, it is said that bladder irritation by it may be avoided. In spite of all objections to its use, great improvement in chronic cystitis is said to follow it. The following formula in elastic capsules is said to be desirable in avoiding gastric symptoms:

- B. Methylene-blue, . . . . . 1 grain.  
Oil of nutmeg, . . . . . 1 drop.  
Oil of sandalwood, . . . . . 2 drops.

The above formula should not be used for more than ten days without intermission, and while giving it the patient should be instructed to drink freely of water.

*Urotropin* may be serviceable in preventing decomposition of the urine and thus allaying irritation and pain. It should always be given in water for fear of irritating the bladder. The usual dose is seven and one-half grains two to four times daily. Five grains suffice in some cases, and in general the writer gives no more of it than absolutely necessary to prevent the urine from becoming ammoniacal. Even large doses of it, however, may fail to render the urine acid in reaction.

Children may take as much as fifteen grains a day. Its chief value is to be found in the case of old men with cystitis from enlarged prostate, probably because in such cases the urine on leaving the kidney is acid, and the bladder-walls are not deeply penetrated by bacteria. The antiseptic body formed

by the Urotropin first inhibits the growth of, and then kills, the bacteria that give rise to the alkalinity of the urine; and the bladder freed from this source of irritation, will, if the drug is resumed from time to time, remain in a good condition. (See HYPERSTROPHY OF THE PROSTATE.)

It may also be used with advantage in inflammatory conditions dependent upon atrophy of the prostate, new growths, and diverticula of the bladder, but in severe cases large doses may be required.

*In cystitis from spinal paralysis* little can be accomplished by local treatment. Thirty-grain doses of *Sodium hyposulfite* are highly recommended for hopeless cases. To make the urine acid give Benzoic or Boracic acid internally.

In acute cystitis *Arbutin* in doses of from fifty to eighty grains a day and *Buchu* in teaspoonful doses of the fluid extract every three hours are often given for the purpose of affecting the mucous membrane of the bladder. Dilute solutions of them are advised by Dr. Fitz.

*Strümpell* commends *Potassium chlorate*, twenty grains in not less than six ounces of water, three or four times in twenty-four hours. It should never be given on an empty stomach. Its value is disputed.

*Cod-liver oil* can be given for the emaciation and weakness sometimes occurring in protracted cases.

*Salol* may be given in cases in which Urotropin is insufficient as a disinfectant. The usual dose is five grains every three or four hours.

Pills containing a great variety of substances are now in vogue for the treatment of cystitis. An example of these is seen in the following made by Parke, Davis & Company:

Boric acid,	1 grain.
Potassium bicarbonate,	1 grain.
Extract Buchu,	$\frac{1}{2}$ grain.
Extract Triticum,	$\frac{1}{2}$ grain.
Extract Corn-silk,	$\frac{1}{4}$ grain.
Extract Hydrangea,	$\frac{1}{4}$ grain.

Atropine sulphate, . . . . . 1000 grain.  
Extract Viburnum prunifolium, . . . . . 1 grain.

For *strangury* (vesical tenesmus) immediate relief may be had from deep urethral instillation of Cocaine (four per cent.) or Silver nitrate (one per cent.). It is claimed that static electricity applied to the spine and hypogastric region alleviates this condition.

*Retention of Urine*.—This may require hot baths, douches, Opium and Belladonna suppositories, with the remedies Aconite, Arnica, Hyoscyamus, Belladonna, Gelsemium or Veratrum. In a few hours, if no relief, the catheter must be used.

**Surgical Measures.**—These consist in washing out the bladder or opening the viscus and draining.

**Washing Out the Bladder.**—Modern methods eschew the use of the catheter. A well-known instrument is that of Valentine, in which hydrostatic pressure suffices for the process, no catheter at all being used.

E. M. Bruce has devised an apparatus of this sort by which the liquid, by care and gentle pressure, may be forced up even past strictures into the bladder. It consists of a heavy eight-ounce, salt-mouthing bottle, fitted with a double perforated cork. Through one opening is passed a right-angled glass tube (A), which must fit tight and extend only a little way below the inferior surface of the cork. To the distal end of it attach a double rubber pressure-bulb, with, say, some three feet of three-sixteenths-inch rubber tubing. Through the other perforation pass a similar tube (B), but it must extend to within one-quarter inch of the bottom of the bottle and be provided above the cork with a valve. To B attach a piece of rubber tubing (same size as to A), and some three feet over this tubing draw a four-inch glass funnel, with the bell opening toward the distal end. This is to catch the splash. Into the end of the tubing insert a piece of glass tubing about three-eighths-inch in diameter, drawn down so as to fit the meatus

of the penis, and of sufficient length to extend two inches beyond the rim of the funnel. Fill the bottle with the solution to be used. Open the valve in the tube (B) and gently press the bulb on the other tube; as soon as the tube (B) is filled with liquid close the valve.

The apparatus is now ready for use. Have the patient hold the glass tubing tightly in the meatus of the penis, open the valve and make a gentle pressure on the bulb. Wash the urethra out well before forcing any liquid up into the bladder. Even if there are strictures, with care and gentle pressure the liquid may be forced up into the bladder. Do not attempt to force in over an ounce or two at first; allow the patient to pass this out and then repeat. Exercise the greatest care and judgment in increasing the amount of liquid injected for each washing.

**Solutions for Vesical Irrigation.**—For irrigation a 1:100 Boracic acid or a 1:1000 or 1:2000 solution of Carbolic acid is employed by Jousset. In very sensitive cases Bruce prefers to anything else the following:

B.	Fld. Ext. Hydrastis (non-alcoholic), . . . . .	3iv.
	Boracic acid, . . . . .	grs. xxx.
	Water, . . . . .	Oj. M.

SIG.—Use at temperature 100°-105° F.

After there is less sensitiveness one gets the best results from Potassium permanganate 1:8000 and gradually increasing to 1:4000.

The bladder is likely to be very intolerant of liquids of a very low specific gravity as compared with urine, so that it is often desirable to add some Sodium chloride or Boracic acid to increase the specific gravity. Distilled water is almost always painful.

Occasionally there is a case which seems to stand still and some more active agent than Permanganate is necessary. Creoline has done good service a few times. Use it in from two to five drops to the pint. It is severe treatment, but occasionally brings good results.

*Washing out the bladder* by use of the catheter is only allowable when the urine stinks with ropy muco-pus, especially when such a condition is the result of residual urine. In other cases renal abscess from ascending pyelitis is possible, especially after fifty years of age. (Fenwick.)

**Use of the Catheter.**—Whenever the bladder becomes sufficiently distended to produce pain and the ordinary remedies fail to give relief, recourse is to be had to the catheter. Before employing a soft catheter it must be soaked for ten minutes in hot soap-water and flushed out with it; then it is disinfected with a strong germicide lotion, preferably corrosive sublimate, from which it must be freed again by another flushing with *salt water* before it is anointed with iodoformized vaseline for introduction.

(The salt water should be tepid and, in strength, a tea-spoonful of salt to a quart of water. The iodoformized vaseline should be 1:50 in strength.)

A simple India-rubber tube is preferable for use in cases in which it can be passed.

After use, the catheter should be again flushed out thoroughly with carbolic or mercurial lotion, dried, and put away in a tight box or wide-mouthed bottle. If needed frequently, the catheter should be kept immersed in a five per cent. carbolic lotion. Before using, however, the adherent carbolic lotion must be always removed by washing in salt water. (See also HYPERTROPHY OF THE PROSTATE.)

Injections may be made by use of an ordinary fountain-syringe. Whatever solution be used, the temperature of it should be 100° F. when it reaches the bladder, say, 105° to 110° in the syringe.

In giving injections an ounce or two only of fluid at a time should be used first, and pain should not be inflicted. The water, after remaining in the bladder for a few moments, should be allowed to run out. It will bring with it at first whatever substance is mixed with the urine—always mucus,

sometimes pus and mucus. The injection should be repeated until the water runs away clear. After a time there will either be an improvement in the bladder itself, or it will have grown accustomed to injections, when larger quantities of water, and often of much higher temperature, may be introduced.

In cases of eccentric hypertrophy use of the catheter is often necessary.

In cases of concentric hypertrophy, on the other hand, the patient should be urged to hold his urine.

**Catheter Fever.**—In cases of chronic retention of the urine death sometimes results from removal of too much urine, due to catheter fever or urinary fever, so called.

According to Klophel, in operations for the relief and cure of chronic retention of urine the complete evacuation of all the urine at first should not be permitted, but rather the withdrawal of a few ounces and the immediate injection of a solution of Boracic acid in volume equal to one-half of quantity of urine withdrawn, lessening at each succeeding injection the quantity of fluid thrown in and increasing the amount of urine withdrawn. Thus, by regular gradation, the bladder is emptied and the circulation in its abnormal walls is accommodated by degrees to the new order of things. The same may be said of the ureters and of the kidneys.

It must be carefully borne in mind that in nearly all chronic diseases of the lower urinary tract the kidneys become involved in time.

*In washing out the bladder* a soft catheter is to be used. In most cases a simple India-rubber tube is sufficient, one end of which is slipped over the end of an ordinary syringe. By nipping the tube the liquid can be retained or the syringe re-filled without trouble. After micturition the soft catheter or tube is passed and any urine left behind drawn off. Several ounces of lukewarm water are now injected and the catheter is withdrawn a little so that the end is brought to the neck

of the bladder. On now opening it the organ is completely emptied. The injections should be continued until the returning liquid is quite clear. The patient should stand during the process, for in this way the sediment is most readily evacuated. After the bladder is washed out antiseptic solutions may be introduced.

**Solutions Used in Washing Out the Bladder.**—Three per cent. solution of Boracic acid is a favorite; one-fourth per cent. Cocaine, one-half per cent. Resorcin, one-sixth per cent. Carbolic acid, five per cent. Sulphate of Soda are used; also, ten drops tincture of Opium in 100 c.c. of water. Astringent injections are one-half per cent. Alum, one-fourth per cent. Zinc sulphate or Carbolate, one-fifteenth per cent. Potassium permanganate, two per cent. Tannin, one-tenth per cent. Silver nitrate. When the urine is very offensive and strongly alkaline any of the following may be used: One-tenth per cent. Potassium permanganate, lukewarm water with a few drops of Amyl nitrite, half a liter (one pint) of water containing three to five drops of Amyl nitrite, one-tenth to three-tenths per cent. solution of Salicylic acid, one-half per cent. Creolin solution, twenty-five per cent. solution of Peroxide of hydrogen. When there is a heavy sediment of phosphates, one-tenth per cent. solution of equal parts Hydrochloric acid and Carbolic acid, or two-tenths per cent. solution of Salicylic acid, or two per cent. Salicylate of Sodium.

In bacteriuria, 1 in 10,000 of Corrosive sublimate.

Supersaturated solution of Boracic acid may be made as follows: Add to one hundred parts of boiling water fifteen parts of Boracic acid and one part of calcined Magnesia; let cool. Lavaux has used this solution successfully in chronic cystitis when the ordinary four per cent. solution failed to relieve. Poisoning from the use of Boracic acid injections is occasionally reported.

*Hydrogen dioxide* may be used as follows: First neutralize with Magnesium carbonate, adding the latter until the solu-

tion fails to redden litmus, then add an equal volume of water, inject and follow with a Boric acid wash.

*Glyco-thymoline*, *Pix-cresol* and *Oxychlorine* are also used. One of the writer's severely painful cases was considerably relieved by use of *Glyco-thymoline* washes. After washing out the bladder with Boric acid solution *Calenduline* may be injected. The bladder may be washed out with *normal salt solution* and ten grains of *Urotropin*, dissolved in one ounce of mucilaged water, may be injected and left in. Instead of *Urotropin* the substances known as *Aminoform* or *Cystogen* may be employed.

Citrate of Silver, 1 to 4,000 or 1 to 10,000 and *Protargol*; also Potassium permanganate, 1 to 4,000; Oil of Cloves in one-quarter to one-half per cent. solution are recommended by Goldspohn.

*Instillation* is another means of treatment and consists in introducing more concentrated solutions in much smaller quantities. In this manner are used Silver Nitrate, 1 to 2 per cent., Bichloride of Mercury, 1 to 5,000 to 1-500, and 5 to 10 per. cent. emulsion of Iodoform. Rovsing recommends 40 c.c.m. of a 2 per cent. Nitrate of Silver solution, and says that so certain is the action of this remedy that if it does not benefit, a complicating pyelitis may be assumed. (Gramm.)

In cases in which after operation the urine still remains cloudy, irrigation with twenty per cent. *Glyco-thymoline* solution may bring about perfect recovery according to G. W. Hopkins, of Cleveland.

*Drainage of the bladder* is indicated in cases of chronic cystitis and is useful in cases of enlarged prostate, when no radical operation is allowed, because of the slight shock compared with that of operations on the prostate itself.

#### TREATMENT OF CHRONIC CYSTITIS IN WOMEN.

In general we must depend upon the following measures:

1. Rest, diet, baths and applications.

2. Cure of any uterine or ovarian disorder present. Employment of plastic surgery.
3. Persistent catharsis if necessary. Internal use of urinary disinfectants, as Urotropin.
4. Dilatation of the urethra.
5. Surgical operation.

In acute cases rest, in a recumbent position, with a diet of milk, copious diluent drinks, mucilaginous drinks, hot sitz-baths, copious vaginal douches and hot turpentine stypes or bran bags to the hypogastric region will give relief.

In case of severe pain anodynes for rectum, as above described.

Persistent catharsis is sometimes a useful measure.

If there are diverticula as in cystocele or procidentia uteri this cause must be removed.

If the inflammation extend from the appendix, uterus, tubes, ovaries, or from pelvic exudates, these sources of inflammation must be treated.

If the urine is hyper-acid, Citrate of Potassium or Lithium should be given in doses of from fifteen to twenty grains, if necessary, three times daily.

When there is mixed bacterial infection and alkaline urine Benzoic acid, in ten grain doses, or Ammonium benzoate can be used.

If Urotropin fails, then try Boric acid in ten grain doses every three hours, or Salol in five grain doses when the urine is ammoniacal. In gonorrhœal cases Copaiba, Oil of Sandalwood and Oil of Eucalyptus in capsule (five to ten minim doses).

Cystitis in women must not be mistaken for irritability of the bladder. In the latter case micturition is frequent and may be painful, but is relieved when the bladder is empty and the urine is free from pus. Pledgets of cotton dipped in a five per cent. solution of Cocaine hydrochlorate and inserted one by one into the urethra may relieve the pain in simple irritability.

In chronic cystitis, however, we may find much difficulty in relieving the patient.

Attention must be paid to the cause of the disorder. The pain and frequency may be due to caruncle in the urethra. Other urethral diseases may be the cause of the unpleasant symptoms, as chronic congestion or suppurating cyst of the urethra, abscess of the urethro-vaginal septum, or a tender, congested condition of the urethral mucous membrane. Chronic congestion of the urethra is chiefly seen in pregnant women; the urethra is swollen and tender and feels like a thick cord. Not only the act of micturition, but sexual intercourse may occasion almost unbearable suffering.

Rectal and anal troubles are a frequent cause of cystitis in women, as are uterine displacements.

Uterine and ovarian disorders must be cured, as a rule, before the treatment of cystitis can be effectual.

According to Morris, fissure of the neck of the bladder is apparently much more commonly met with than fissure of the anus, but seldom recognized. The fissure can be seen by gently distending the urethra with proper specula and throwing in light with a head mirror. It is a narrow, grayish ulcer, similar to a narrow aphthous spot in the mouth. The primary symptoms are pain on urination, lasting tenesmus after urination and frequent urination. Secondarily come catarrhal cystitis and nervous derangements. The ulcer may be caused by the compression of folds of the urethral mucous membrane, by a uterus out of place, from a scratch, by the passing of a bit of gravel, or it may be simply microbic, as the aphthæ of the mouth are now known to be.

The various causes for cystitis must, therefore, be attended to before we can expect much benefit from general treatment. For caruncle E. S. Bailey, of Chicago, uses the electric needle.

For urethral fissure the treatment consists in dilating the urethra slowly with the finger, to accomplish the same end as when we stretch the sphincter of the anus for fissure in that

locality. Immediately after urination a few drops of a five per cent. Cocaine solution injected at the neck of the bladder will at once control the painful tenesmus. The wool tampon for the vagina will give a feeling of great comfort and lessen the tendency to spasm of the bladder. Absorbent cotton should never be used for the tampon, because when it becomes stony in a few hours it irritates the bladder, just as it usually does the uterus.

The above treatment failing to cure, the bladder should be opened to give the urethra rest. This is done by introducing a Sims uterine dilator through the urethra, pressing the bladder-wall backward and then slipping a scalpel through the wall between the blades, entering from the vaginal surface. In one aggravated case, recently, Morris opened the bladder above the pubes and poured into it, twice daily, an ounce of a mixture of Boroglyceride and Glycerin. Boroglyceride and Glycerin is the best thing for any sort of hypertrophic catarrh. Clots in the bladder should be digested out with Pepsin. If the bladder is acidulated with Citric acid, Pepsin will digest the thick tenacious muco-pus quickly and give patients great relief. In old cases, with contracted bladder, expansion daily with Davidson's syringe and warm Boric acid solution will gradually enable the bladder to hold a pint or more of urine.

Dilatation of the urethra may be helpful in cases where tenesmus is a distressing feature and in which the parts around have become contracted and hypertrophied. Faradism with one pole near the uterus and the other over the bladder may give great relief.

If no organic changes have taken place, injections of Mercuric chloride solution, 1 to 2,000, will help a train of symptoms due to suppuration, uncleanliness and the like.

Dr. Madden, of Dublin, treats severe cystitis in women by dilating the urethra, which permits a continuous outflow of the secretion; this treatment, together with mild washing of

the bladder, usually effects a speedy cure. If not, the fundus and neck of the bladder should be wiped with a bit of cotton soaked in carbolized Glycerin and passed through the dilated urethra. The use of Cocaine will prevent the pain of the operation.

In general, before any operative interference is undertaken, the urine should be normally acid ; this can generally be accomplished by the free use of Citric acid in the shape of lemonade or lemon juice and water ; the mineral acids act more slowly, and Benzoic acid is not often well borne by the stomach if administered for too long a period of time. The use of Citric acid in one day has been known to remove a thick phosphatic crust on the edges of a vesico-vaginal fistula, or on the wound through the perinæum in lateral lithotomy.

**General Treatment.**—*Rest* is essential and probably of more value than washing out the bladder. Lying on the stomach in bed is advisable.

Special attention is given to diet: Bread and milk, soft-boiled eggs, toast, chicken, baked potato and milk, dipped toast, hasty pudding and such articles of diet have the preference ; especially avoid tea, coffee, spices and anything which may increase irritation of the kidneys.

The bowels are to be regulated with great care. Either Rubinat water or Tarrant's aperient are usually well liked by women and are efficacious.

Where there is prolapse or misplacement of the uterus use ring pessaries of tarred jute, which are very acceptable to the patients.

Besides the injections into the bladder use hot sitz-baths, once or twice a week, together with injections into the vagina of hot water with Boroglyceride.

After the injections use suppositories of Boroglyceride, and where the pain is sufficiently severe to warrant its use add a sufficient quantity of Morphine to allay the pain.

In acute cases cataplasms, baths and hypogastric fomenta

tions are useful. Topical applications in the vagina assist in allaying inflammation about the neck of the bladder:

Camphorated lanolin, . . . . .	3 ij.
Extract of Belladonna, . . . . .	3 j.

Saturate a tampon with the above and introduce night and morning into vagina.

When the pain is intense apply in the same way:

Muriate of Cocaine, . . . . .	gr. xv.
Distilled water, . . . . .	f 3 vj.

Internally, for the acute form of cystitis:

Oxalic acid, . . . . .	gr. viij.
Distilled water, . . . . .	f 3 iiij.
Syrup bitter orange-peel, . . . . .	f 3 j.

A dessertspoonful every four hours.

For insomnia, Chloral per rectum as follows:

Chloral hydrate, . . . . .	3 j.
Yellow of one egg,	
Water or milk, . . . . .	f 3 iiiss.

(Lutaud.)

The following cured one of Hale's cases in four days:

B. Balsam copaiba, . . . . .	3 ss.
Oil sandalwood, . . . . .	3 ss.
Oil cinnamon, . . . . .	3 i.
Emulsion acacia, . . . . .	3 iiiss.
Simple elixir, . . . . .	3 iiij.

Sig.—A dessertspoonful every four hours.

Unfortunately, however, we have no information as to the cause or character of the malady in this case.

In many cases internal use of *Aminoform* or *Urotropin* will prove curative, prevent ascending pyelitis and lessen the need of surgical interference.

#### TUBERCULOSIS OF THE BLADDER.

**Etiology.**—The disease is rarely primary. If primary, the trigonal submucosa is by far most likely to suffer. The cause

is generally tuberculosis of a neighboring or associated organ.

In rare cases it is directly secondary to tuberculous disease of the lungs or intestines. When it is part of a urogenital tuberculosis, the starting point may be the kidney, or the prostate, or seminal vesicle.

**Occurrence.**—It occurs usually in young patients, from fifteen to twenty-five years of age, with family history of tuberculosis or cancer, and personal history of masturbation, with increasing frequency of urination, or of chronic inflammatory disease of the urogenital tract. It is most common in men under the age of forty, but may also occur at the extremes of life.

**Pathology.**—The bladder may be invaded in two ways: First, and more commonly, by surface inoculation by the stream of tuberculous urine from the kidney or its pelvis; second, by continuity along the line of the ureter, or from the prostate or seminal vesicles.

Tuberculosis of the kidney may not, if the bladder is healthy, necessarily infect the bladder, but an unhealthy condition of the inner bladder wall or instrumentation may give rise to infection of the latter; or the germs may be introduced into the bladder upon unclean instruments, or be dislodged from the urethra and carried back. The bacilli may, in some cases, enter the bladder from some remote tubercular lesion through the blood or lymph channels.

Tuberculosis in the bladder presents itself as an infiltration about the mouth of the ureters and the neck of the bladder. Ulceration occurs early, extends to a varying depth, often undermining the mucosa, and occasionally perforating into the perivesical tissue or rectum. Tubercles may be seen on the floor of the ulcers. Cystitis and hypertrophy of the bladder are generally associated with it.

Irritating products of tubercular inflammation affect the trigonal mucous surface, causing symptoms resembling gonorrhœal cystitis. If, then, an excoriation takes place from

the irritation, or a rent is made by an instrument, tubercular infection is easily accounted for.

Extension by continuity from the ureter results in swelling, congestion, excoriation, and finally ulceration.

**Diagnosis.**—The disease is to be suspected when a patient between fifteen and thirty-five years of age complains of frequent micturition and slight haematuria aggravated by a reclining position, and where there is a tubercular family history or tubercular nodules can be found in the epididymis, vas, prostate, lungs, or other organs. (Carleton).

**Clinical Features.**—*In primary cases* of invasion of the middle coat of the bladder from the blood-vascular channels the symptoms are none, or but slight. If any, they are usually as follows :

Slowness in starting the stream, weakness of flow, and difficulty in emptying the bladder.

Residual urine in more or less quantity in later stages.

Gnawing pain behind the pubes when the bladder is disturbed, not quickly relieved by urination.

Slight haemorrhages from over-distension.

In other words, symptoms closely resembling those of obstructive prostatic disease.

*In secondary cases* the features are those of stone in the bladder (See STONE IN THE BLADDER), except (1) that the frequency of micturition is not relieved by rest, (2) the pain is referred to the centre of the penis or is felt in the perineum.

In women haematuria is often the first symptom and is generally accompanied by a pulpy growth around the meatus. (Carleton.)

The first symptom is usually frequency of urination, especially at night, finally becoming almost incessant. Retention or incontinence may occur, the latter in the ulcerative stage.

Pain may be felt before, during and after urination.

In half the cases haematuria is the first symptom. The

amount of blood varies from a few drops to profuse and even fatal haemorrhage.

When cystitis is established, the pain becomes severe or even agonizing; tenesmus and retention may take place from the lodging of clots in the urethra, with consequent pain in the supra-pubic and perineal regions.

**The Urine.**—This presents no characteristic features other than may be found in any diseases of the bladder in which blood, pus, phosphates, and débris occur, save for presence of the Bacillus tuberculosis. For detection of this bacillus see **RENAL TUBERCULOSIS**.

**Course.**—The disease pursues a chronic course with acute exacerbations. In the earlier stages the health is not much affected. In some cases it does not prevent a long duration of life. The onset may be gradual and insidious.

**Differential Diagnosis.**—Vesical tuberculosis is to be differentiated from vesical calculus as follows:

Absence of history of passage of renal calculus.

Exercise does not cause so marked an increase of vesical irritability.

The pain is in the middle of the penis, and does not pass forward under the glans.

The sudden arrest of the stream relieves the pain.

Nocturnal frequency rapidly increases, depending on distension reflex.

Evidences of a contracting bladder are present.

Presence of tubercular products in the urine.

Cystoscopic examination shows no stone.

*Vesical tuberculosis coming from an infected seminal vesicle* can be distinguished from vesical calculus as follows:

In tuberculosis from this cause the bladder is unable to hold more than five or six ounces; the pain ceases when about half of this is voided; there is much straining at the end of urination, and extrusion of a few drops of blood; the distress subsides as the bladder is partly filled; day and night

frequency is about the same ; the cystoscope shows a patchy inflammation along the side of the affected vesicle only.

Primary vesical tuberculosis can be differentiated from obstructive prostatic disease by observation with the cystoscope that a patchy disseminated tuberculosis is present under the transparent mucous lining of the bladder.

Vesical tuberculosis coming from the prostate must be distinguished from cystitis of the neck. Differential diagnosis is to be made as follows : The finger in the rectum detects an unusual sensitiveness in the intervesicular space, especially if the bladder is partly filled. Distention reflex is marked. Nodules may sometimes be felt in the bladder wall. The detection of the disease in the prostate usually serves to do away with the necessity of instrumentation.

*In general, use of the cystoscope for diagnostic purposes enables us to do away with that of the stone-searcher, a most dangerous instrument in tuberculous cases.*

When a tubercular condition of the kidney extends to the bladder, the clinical symptoms resemble closely those of renal calculus ; when it extends from the seminal vesicles, it simulates vesical calculus, and presents as a clinical picture frequent desire to urinate, caused by a contracted vesical cavity ; often in the early stage it will not contain more than four ounces of urine. In the last stages the thickening of the bladder walls may be so marked that the viscus will not contain more than one or two ounces. Pain is relieved when the bladder is half empty. The act of micturition is followed by a few drops of blood.

When the lesion originates in the prostate, in conjunction with evidences of acute prostatitis and haematuria, a rectal examination will reveal an enlarged nodular gland, etc. In tubercular cystitis retention of urine only occurs when the neck of the bladder or prostate is involved. (Carleton.)

**Treatment.**—In early stages of primary vesical tuberculosis a cure may be obtained from supra-pubic cystotomy, curette-

ment or cautery of the lesions, or destruction of these by means of Lactic acid applications, rubbing in of Iodoform thoroughly into the diseased area, followed by drainage for a few weeks, bladder irrigation with solution of Mercuric chloride 1-2,000 to 1-20,000 being made daily.

In extreme cases the bladder has been removed and the ureters implanted in the intestines or rectum.

In general, where operative measures cannot be undertaken, the following treatment should be carried out :

1. Residence in climate suitable for tuberculosis.
2. Avoidance of chill.
3. Use of nourishing, easily-digested food, containing as much fat as can possibly be digested.
4. Hydrostatic bladder irrigations of solutions of normal salt, weak Salicylate or Borolyptol, or injection of emulsions of Iodoform.

Iodoform injections may be made as follows: Three or four ounces of a five per cent. solution of Iodoform in liquid vaseline are injected into the bladder every two or three days, the patient being instructed to watch the stream when he urinates and stop the flow just as soon as the oil appears. This forms a permanent Iodoform dressing of the bladder-wall, and in the hands of some of the French surgeons is said to have met with gratifying results.

Picot prefers to use olive oil instead of vaseline, as the latter has been known to furnish a nucleus for calculus. His formula is Guaiacol, 5 parts; Iodoform, 1 part; sterilized Olive oil, 100 parts. Ten to twenty drops are injected daily.

Alfred K. Hills uses irrigations of Borolyptol, in strength 1 in 8 to 1 in 16, relieving disagreeable subjective symptoms by internal administration of a mixture containing 10 minimis of the tincture of Belladonna, 15 grains of Benzoate of Sodium, and oil of Gaultheria to make one drachm; given three times daily.

After irrigation by any agent instillations of from ten to

forty drops of Mercuric chloride solution, (strength ?) repeated every two or three days, have been well spoken of. (Carleton.)

The remedies used most commonly are *Cantharides* for the pain and haematuria (not in large doses), *Guaiacol* or *Creosote* in doses of from three to twenty drops, three times daily, given for a long period.

The oils of Sandalwood and Cubeb have also been employed.

*Tuberculocidin*, Klebs, has been used successfully by Roerig in the treatment of tubercular ulcer of the bladder.

The ulcer was situated between the urethra and the right ureter (tuberculous cystitis). The bladder was very sensitive and held sixty ccm. The subjective symptoms were severe. Various therapeutic measures were tried unsuccessfully, such as instillations of Guaiacol-iodoform emulsion, later 1:5,000 corrosive sublimate, and stronger, with cleansing of the ulcer. *Tuberculocidin*, Klebs (Tct.), was then used, at first five drops, which was increased gradually to forty drops a day. Once in two or three weeks the instillations of sublimate were repeated. The *Tuberculocidin* was also used locally by injecting five grains of the tincture into the bladder just after emptying it. The results of three months of this treatment were remarkably good. The patient was able to work, free from pain, slept normally, had no tenesmus, and an increased bladder capacity.

#### SYPHILIS OF THE BLADDER.

This is said to occur, but is exceedingly rare.

#### TUMORS OF THE BLADDER.

There is a marked tendency on the part of tumors of the bladder to be polypoid. Other kinds, however, may occur.

**Classification.**—A division of bladder-tumors may be made as follows :

I. *Benign*.—Papilloma, myxoma, liomyoma, fibroma; rarer forms: angioma, cysts. Cysts hydatid, dermoid and serous; they are rare.

II. *Malignant*.—Sarcoma and cancer. Sarcoma shows the following varieties: Fibro-sarcoma, lympho-sarcoma, myo-sarcoma, round-cell and spindle-cell. Cancer is either flat-cell or glandular.



FIG. 28—Vesical Polyp.—(From THOMPSON.)

*Papilloma* is the most frequent of benign growths, *carcinoma* of malignant. Sarcoma is, however, not so rare as formerly thought.

**Occurrence.**—Middle life is most subject, except in the case of myxoma, which is more often found in childhood. Males are more liable than females. The lower third of the bladder is more liable to growths than the upper two-thirds.

Secondary carcinoma as the result of extension of uterine or vaginal carcinoma is comparatively frequent in women. Women in fuchsin factories are said to be especially liable to bladder-tumors.

#### BENIGN GROWTHS.

*Papilloma*.—A rather common tumor is the *soft* or *villous papilloma* a pediculated or sessile growth having its most frequent seat in the region of the trigone. (FIG. 29). It may be small and slender, projecting like a tendril into the bladder or it may be a large cauliflower-like mass.

The pedicle varies in length, thickness, and structure. It may be as long as an inch or more, and it varies in size from that of a knitting-needle to that of the thumb, or larger. The structure of the papillæ is as follows: Their base is made up of unstriped muscular fibre and connective tissue. From this spring the individual papillæ. Each of the latter consists of a delicate framework of connective tissue, through the centre



FIG. 29.—Papilloma of the Bladder.—(From THOMPSON.)

of which run loops of capillary blood-vessels with very delicate walls, lined with endothelium, bearing endothelia with large nuclei. Externally each papilla is covered with one or more layers of epithelium of columnar form with large nuclei; these are of the same type as the epithelia of the deeper layers of the normal mucous membrane of the bladder.

Sometimes the tumor occupies an extensive area along the surface of the urinary tract. Bleeding is very common and may lead to grave consequences.

Not rarely villi become detached and appear in the urine. The tumors though benign tend to recur after removal and oc-

asionally seem to become carcinomatous or to ulcerate. Cystitis accompanies them as it does other tumors of the bladder.

*Myxoma*, or polyp, is a single growth, pedunculated, and resembling in gross appearance nasal polypus. (Fig. 28.)

*A mucous polyp* occurs but rarely but it may be of inflammatory origin rather than a true tumor.

*Myomas* are rare, only about sixteen cases being known, but they have been found in both sexes and at the two extremes of age.

They are very analogous in their character and structure to uterine fibromas. They spring from the thickest part of the muscular wall of the bladder, and extend either on the outside or inside of that organ, hence the division into "myomes excentriques" and "myomes cavitaires." (Albarran.) The latter are the more frequent. They may be sessile or pediculated, and their size may vary from that of a nut to that of an adult's head, and even larger. They are usually very limited, encapsulated, and easily enucleated.

In the case of a "myome excentrique," there are scarcely any vesical symptoms; the myoma only betrays its presence by the slow growth of a tumor which hinders the function of neighboring organs.

In the case of a "myome cavitaire," the ordinary symptoms of vesical neoplasms are observed: frequent haematuria, painful micturition, sense of weight in the perineum or hypogastrium.

By rectal or vaginal examination, especially when combined with abdominal palpation, the presence and nature of these tumors may often be made out.

The progress of these myomata is variable; death is oftenest the result of the secondary accidents of infection. (Terrier and Hartmann.)

## MALIGNANT GROWTHS.

*Carcinoma*.—The stroma of a carcinomatous growth, composed of the tissue of the submucous and vascular layers of the bladder, with more or less round-celled infiltrations, is full of alveoli, well packed with epithelial cells, following with more or less accuracy the types of the bladder epithelium. The formation of cancer "nests" varies much in different specimens, and often in different parts of the same specimen.

Squamous epithelioma is the usual type of malignant epithelial growth. It may be villous or infiltratory, the latter causing marked thickening of the bladder wall. Horny change and metastasis are rare.

*Sarcoma* is rare, is usually large in size, multiple, situated about the orifices and sometimes infiltrates the bladder wall, causing an enormous thickening. Sarcoma has been found in the bladder in one case which was that of a worker in a fuchsin factory.

**Diagnosis.**—The cystoscopic examination of the bladder is the surest means. Intermittent haematuria and pain in the bladder should suggest the presence of a tumor.

**Clinical Features.**—These are the following:

1. Haematuria preceding pain in benign growths and often in the beginning symptomless.
2. Pain or irritability of the bladder often preceding haematuria in malignant growths.
3. Relief of pain after an attack of bleeding.

The haematuria of bladder-growth may take place even during sleep, is very abundant, and shows progressively increasing frequency and abundance as the disease progresses. It is, as a rule, intermittent.

Occasionally haematuria is continuous.

Instrumental manipulation within the bladder is liable to produce haemorrhage, and one or two fatal cases from this cause are on record.

The pain is not, as a rule, increased by exercise.

In malignant growths pain is a prominent symptom sooner or later, and is frequently of a radiating character. In exceptional cases pain may be absent.

Frequency of micturition is not more noticeable at night.

In several cases of bladder tumors which the writer has seen a remission of symptoms has followed attacks of haematuria, the patient has insisted that nothing serious was the matter with him and operation has been refused.

Enormous clots of blood may be voided, some of them organized and comparatively firm in consistence.

Tumors of the bladder may grow about the urethral orifice, cause hydro- and pyo-nephrosis, and death, with renal symptoms, suggesting Bright's disease.

In one of the cases mentioned above, in which operation was refused, the patient ultimately died of uræmia.

In one other case a prominent feature was great pain and straining with the passage of the clots.

The first symptom of haematuria is often followed by an impediment to urination and to mechanic obstruction of the orifice of the urethra. Later we have the kidney-ache, which is caused by the ascending inflammatory changes and is felt on the side on which the tumor is located. These symptoms are sooner or later followed by a cystitis, unless great care is exercised in the management of the case. This confuses the diagnosis, complicates the disease, and may eventually end the life of the patient by developing a pyonephrosis. (Wathen.)

*Carcinoma of the bladder* is often concealed by the presence of chronic cystitis and is sometimes associated with stone. In the writer's experience it is difficult to recognize in certain cases. It should always be suggested by pallor and rapid loss of flesh in elderly patients who have cystitis, even if stone is also present. Induration of the inguinal glands is sometimes of service in the diagnosis as is palpation by the rectum or vagina with discovery of an indurated area in the bladder.

Scratches on the catheter are serviceable in making the diagnosis, inasmuch as the growth may be covered with crystals. Fragments of the growth may be found in the fenestrum of the catheter.

In rare cases in women Eichhorst has observed the growth projecting into the urethra. There may be severe pain in the hypogastric region at night radiating into the loins and thigh, retention or incontinence of urine, and febrile symptoms if the urine decrease in amount.

In a case which the writer saw the chief features were frequency of urination, pain on urinating, especially at night and great restlessness and nervousness. There had been haematuria in the past but none was observed while the patient was under the writer's observation.

**The Urine.**—The features are the following:

Presence of blood.

Presence of bits of the surface of the growth.

In malignant disease large numbers of epithelia of a great variety of shapes, with many and large nuclei. The *quantity* of these epithelia is of importance.

In order to find the bits of growth, the writer has resorted successfully, in one or two cases, to the following simple method :

The urine is diluted with water until the blood-corpuscles are in large part dissolved, after which sedimentation in the centrifuge will easily collect the particles, if present, which, if examined with the microscope, show great abundance of connective-tissue shreds. (See URINARY ANALYSIS, p. 315.)

In *fibrous polypi* there is cystitis of moderate severity.

*Medullary sarcoma* may be characterized by urine of greenish-brown color and putrid odor. In later stages there may be a severe cystitis.

In *epithelioma* we find a moderate or sometimes severe cystitis. In the sediment there are present blood, pus, small, round or oval epithelial cells, sometimes caudate cells with

two or three small projections, their nuclei large and brightly glistening, with several in the same cell. Sometimes ten or twelve cells may be found together, forming a shred.

In *villous* or *vascular* tumors the urine is normal in quantity, red-brown to brown-black in color, feebly-acid reaction, but alkaline when tumor grows rapidly; the sediment is fine, flocculent, brownish in color, with reddish or large shreds; the urine is usually normal in consistence, but at times stiffens suddenly to a jelly-like mass; after long shaking, again becomes liquid and of slightly reddish-yellow color. Sometimes there are severe symptoms on micturition.

In one case of carcinoma the writer found twenty per cent. of albumin by bulk in the urine without blood or pus to account for it and no casts.

**Physical Examination.**—When there is no prostatic hypertrophy, the finger in the rectum may detect an area of induration in the case of malignant growths, and a sense of increased resistance. The bladder should be nearly or quite empty.

The cystoscope is another means for detection. If for any reason it cannot be used, digital exploration of the bladder by way of the perinæum is the last measure at our command.

According to Wathen, when we inspect the bladder with the cystoscope, we may encounter two well-marked varieties of vesical tumors—the villus-covered and the bald. The villus papilloma may be malignant or benign, but the bald is always malignant, and particularly so if the patient is over forty-five years of age. The villus papilloma resembles chorionic villi, which are of a light fawn color, showing beautifully the capillary circulation. They float about in the urine, and resemble sea-weeds under the water. Their attachment to the bladder wall is always outside the trigonal area, to the outer side of the orifice of the ureter, and more often in front of it, while sometimes they arise from the true lip of the ureter itself, and thus have probably been caused by some direct irri-

tation of an unusual kind from the urine of the kidney on that side.

The pedicle of this variety of tumor varies in size from a mere thread to that of a quill, and the larger the pedicle, or base, the more liable it is to become malignant. The multiplicity of villus papilloma also tends toward malignancy.

The benign papilloma is very liable to undergo a gradual malignant transformation of the stalk or pedicle. The villus malignant papilloma or carcinoma is less liable to be single, and occasionally a certain proportion are partly free from villi, and approach the bald type. These have a large base or pedicle, and show a tendency toward infiltrating the bladder wall. They are more often situated on the right side near the orifice of the ureter, and the first symptoms of haematuria occur usually between forty-five and sixty years, while the benign appear earlier. The bald is the most malignant of the bladder tumors, and differs from the two preceding forms in that it tends to involve the bladder wall, is not so prominent on the surface, and the rapidity with which other vesical symptoms appear—as cystitis, pain, etc., after the initial haemorrhage. These tumors also appear near the ureters, and present a bald, irregular, nodular growth of a dull red color similar to that inside the mouth. It is in strong contrast to the white color of the posterior wall.

**Differential Diagnosis.**—Benign growths are to be differentiated from malignant growths as follows: If the area of induration can be felt by the finger in the rectum, if the patient be over 50 years of age, and if the cystoscope shows a growth with an ulcerated surface having irregular, ragged, everted and edematous edges, and if pain is a marked symptom, the chances are strongly in favor of the disease being malignant.

Examination of the blood should be made in doubtful cases.

According to Wathen, pain is a more prominent symptom in the bald type of tumor, and the extent of involvement of the bladder is better told by the extension of the pain than by the hardness of the vesical wall.

In summing up the points of differential diagnosis of tumors of the bladder, the following are the principal facts to consider : The benign villus appears between thirty and forty-five ; the initial haemorrhage is rarely severe, fragments are often evacuated, and the prognosis as regards length of life is good.

The malignant villus appears between fifty and sixty, haemorrhage is very rarely severe, fragments evacuated are common, and the average life is about eight years.

The bald malignant appears between fifty-five and sixty-five, haemorrhage is commonly severe, fragments are rarely evacuated, and the average life is a little over two years. The softer tumors have longer periods of haemorrhage, while the denser ones exert their energy in infiltrating the vesical wall.

"Most tumors, whether benign or malignant, terminate the existence of the patient by inducing renal complications." (Fenwick.)

The larger and thicker the stem or pedicle of the tumor, the more malignant it is liable to be and the sooner will result infiltration of the bladder wall, followed by irritability, pain, cystitis, pyonephrosis, and death.

**Effects.**—Compression of the ureters by the tumor may lead to hydronephrosis, pyelonephritis, pyonephrosis and septicæmia. Rupture and uncontrollable haemorrhage may result.

**Course and Prognosis.**—Bladder-growth progress slowly. The average duration is from three to seven years, but the patient may, in exceptional cases, die in a few months, from frequent and repeated haemorrhages or from cystitis and nephritis superadded.

*Death is the inevitable result of bladder-tumors when left to themselves.*

In carcinoma of the bladder death may take place in a year from exhaustion, urinary septicæmia, rupture or uncontrollable haemorrhage.

Supra-pubic incision and drainage early may prolong life and relieve pain.

**Prognosis after Operation.**—Thompson reports forty-one cases. In seven papillomatous cases there was no reappearance of symptoms in from three to ten years. In fifteen other cases death took place; ten were malignant, two papillomatous, and the rest myomatous, with suspicious nuclei. Nineteen others lived from a year to a little less than four years after operation.

Watson has collected statistics of eleven others, three of whom died in from six months to two years, one showed recurrence in from two to five years, one showed no evidence of recurrence in four years, one none in five, and in one the result was not stated.

In sarcoma the statistics of Hinterstoisser show the following: Of twenty-one cases twelve died, six recovered, three were unrecorded. The longest period without recurrence which Watson has recorded is that of five years.

Fenwick reports 135 operations out of 500 cases with only five deaths due to operation.

**Treatment.**—In cases where operation cannot be performed vesical irrigations of Silver nitrate, one grain to one drachm of distilled water acidulated with a little Nitric acid, are endorsed by Carleton in the following manner:

In the first irrigation half a drachm of the solution is added to four ounces of warm water, the strength being gradually increased every day or two until one or even two drachms are employed, regulating it so that no pain, increased frequency of micturition or straining follows the irrigation. Occasionally, when the solution of maximum strength has been in daily use for a considerable period, the bladder becomes irritable, and a weaker solution must be employed, but the treatment should not be discontinued. About two ounces of the selected solution should be introduced into the bladder, retained for a few seconds, then allowed to discharge itself

through the catheter while the syringe is being refilled. The douching must be repeated daily and continued without intermission for four, five or six months, reaching the maximum strength of solution some five, six or more weeks from the commencement of the treatment. If bleeding has ceased, as it should, the irrigation must be continued every other day for six months or longer, and afterwards every third day for a variable period. After this long course of treatment the application may be discontinued, even for a year, without any symptoms recurring ; but should blood re-appear in the urine the daily douching—commencing with the minimum strength and gradually increasing—must be again resorted to. In this way haematuria, as well as the growth, may be permanently controlled, and the patient may live in comfort for many years. The treatment, at the start, may occasionally increase the haemorrhage, but after several applications the blood lessens in quantity and finally disappears. Sometimes it never entirely ceases, being especially noticeable in small quantities at the time of catheterization, though every precaution may have been taken in introducing the instrument. It is apparently caused by the catheter damaging a growth situated near the neck of the bladder. In such a case, when the treatment is discontinued the haemorrhage ceases, and the after-effect may be quite satisfactory. (*Uropoietic Diseases*, second edition.)

To check haematuria, which is sometimes exhausting and dangerous, Francis Watson advises long-continued irrigations of the bladder through a soft rubber catheter with very hot water,  $110^{\circ}$  to  $120^{\circ}$  F. The use of strong astringents and of styptics within the bladder cannot be advised, as they are liable to produce tough coagula.

In cases where the coagula have formed, it is wiser to allay tenesmus and pain with Opium than to attempt to remove the clots. The pressure caused by the filling up of the bladder tends to check the haemorrhage after a time, and in a few

hours the clots will disintegrate and pass away. If the patient's general condition is bad, and the flow of urine and blood distend the bladder to a dangerous degree, attempt may be made to break up the clots and wash them out with large catheters or evacuators.

Adrenalin chloride solution internally is used, together with washing out the bladder, to stop the haemorrhage with good results, but it will not always stop the haemorrhage entirely. The use of normal salt solution in cases of collapse should not be forgotten. The following precautions should be observed :

The most important indication in the use of infusion into the vein is that the temperature of the fluid should be equal to that of the blood or above. If the temperature is below  $100^{\circ}$  shock may be distinctly increased. The infusion into the vein, as ordinarily given, is much below the temperature that it should be. If a metal or glass tube is inserted into the vein it of necessity cannot be very large ; the flow of fluid through the rubber tube of the syringe cools it very rapidly, so that with ordinary room temperature, if the fluid in the bag has a temperature of  $105^{\circ}$ , it actually enters the circulation of the patient at about  $90^{\circ}$ . This can be obviated by using one of the mechanical arrangements for warming the fluid while in the bag, and also while it is in the tube. If an ordinary rubber tube is employed it may be surrounded with gauze saturated with hot water.

Under no circumstances should an infusion be made directly into a vein unless there has been a loss of blood. If the symptoms of shock are not accompanied by haemorrhage the injection of the hot normal salt solution should be into the colon or into the subcutaneous cellular tissue. The injection of the colon is probably the most efficient, but here the temperature should be  $115^{\circ}$ . (*Therapeutic Gazette*.)

In the treatment of toxæmia saline solution will unquestionably play a most important rôle in the future. If the

fluid is injected into a vein the same rule should be followed, that there must be an extraction of blood. In cases of general sepsis, pneumonia, uræmia and other toxæmic states, preceding the injection, there should be a free bleeding of the patient. If the blood is not removed, resort must be had to the hypodermic or the colonic injection.

In cases of emergency an approximately accurate solution can be prepared by adding a teaspoonful of table salt to a pint of water. A much more accurate formula, and one which more nearly represents the saline constituents of the blood, is that proposed by Dr. H. A. Hare, which is composed of the following ingredients :

Calcium chloride, 0.25 grammes;  
Potassium chloride, 0.10 grammes;  
Sodium chloride, 0.9 grammes;  
Sterilized water, 1000 cc.

**Surgical Treatment.**—In benign growths removal should be undertaken at the earliest possible moment, unless the patient be exhausted, or renal disease or other complicating malady contra-indicate operation.

In malignant growths the decision as to operation depends upon the amount of pain or haemorrhage present. Operation as a palliative measure may be required in cases of extreme pain or haemorrhage.

In certain cases of cancer in which the growth is of limited extent, and situated at or near the summit of the bladder, resection is occasionally successful.

According to Wathen in regard to the operative interference with vesical growths we should be guided by the extent and character of the tumor. When the bladder wall has been infiltrated, so as to be felt per rectum, we should not attempt to remove the tumor unless we remove the entire bladder, and if this is impracticable we may substitute a supra-pubic incision to relieve the pain and for better drainage. Most operators condemn the perineal route in this condition, as it

increases the pain and vesical spasm, and Fenwick says that "Perineal cystotomy for a radical attack on vesical tumors does not deserve the name or cloak of surgery."

When we have a single villus-covered pedunculated tumor, with unilateral renal pain, or causing an obstruction of the urethra, we should make a small supra-pubic incision and remove the growth.

#### PARASITES AND OTHER FOREIGN BODIES.

Animal parasites are the Distoma, the Filaria and the Echinococcus. Cysts of echinococcus may be found free in the bladder. The distoma may apparently cause a fungoid tumor. The ova may be found in the urine. In cases of fistula, oxyuris and ascaris may enter the bladder.

Bacteria, yeasts and the thrush-fungus have been found in the urine in the bladder, the two last more commonly in diabetes mellitus. The thrush-fungus (*Oidium albicans*) may cause a white deposit on the mucous membrane.

*Leptothrix* may be present in the bladder, and the fine, hair-like particles be present in the urine. *Sarcinæ* are also found.

Bacteriuria, the voiding of bacteria in fresh urine, is frequently observed; the urine may then have the odor of stale meat-broth. Salol in fifteen-grain doses every two hours is the best remedy, but should be discontinued or lessened in amount if the urine darkens during administration of the agent.

Among other foreign bodies found in the bladder are fragments of catheters, hair-pins, pipe-stems, spicules of bones, bullets, etc.

These objects may serve as a nucleus for stone formation. In cases of vesico-intestinal fistula, striped muscular fibres, vegetable cells and food may be found in the urine. Flatus into the bladder may be observed in such cases. Gall-stones have been found in the bladder.

Hair from dermoid or ovarian cysts, bits of cartilage, bone and even teeth may be passed from the bladder into the urine.

## STONE IN THE BLADDER.

**Synonyms.**—Vesical calculus.

**Etiology.**—For the formation of stone in the bladder two conditions are essential :

1. A tendency toward *deposit* of the urinary solids from solution in the urine.
2. A local disposition for the solids thus deposited *to adhere to a nucleus* or matrix.

The nucleus is usually organic—an albuminous or mucinous coagulum derived from the mucous membrane. In the bladder, however, an aggregation of uric acid crystals, depositing originally in the kidney and passing into the bladder, or in some ten per cent. of the cases extraneous substances, as blood-clots, alteredropy pus mixed with precipitated phosphates, or aggregations of crystals of oxalate of calcium from the kidneys, may serve as a nucleus. Urate and oxalate stones from the kidneys are likely to be crusted with phosphatic material in the bladder.

**Classification.**—Calculi in the bladder may be divided into three classes, as follows :

1. Those formed from normal constituents of urine : uric acid, urates, phosphates and mixed calculi of uric acid or urates coated with phosphates.
2. Those formed from normal constituents, but not deposited in normal urine : oxalate and carbonates.
3. Those formed from substances entirely foreign to normal urine : indigo, xanthin, cystin.

**Physical Characteristics of Calculi.**—Vesical calculi are usually solitary, but cases are known to the writer in which a number have occurred, with the result that the crushing operation resulted fatally in one case.

They vary in size from that of a large pea to a magnitude limited only by the capacity of the bladder. The hardest stones are likely to be solitary, namely, the uric acid and the oxalate.

As a rule, they are rough from crystalline deposits, but cases occur in which they are smooth.

The average size is from one to two inches and the weight from two drachms to one ounce. The shape of single stones is usually a flattened oval ; a multiplicity of them produces a flattening of opposing surfaces. The oxalate stone is the hardest and the phosphatic the softest. They may be either homogeneous in composition or consist of alternating layers of different substances.

Uric acid stones are multiple, small, hard, gray-yellow or reddish-brown. If smooth, they cause but slight cystitis.

Urate calculi are often encrusted with oxalate or phosphate. They are common in the region about Chicago.

Phosphatic calculi are dirty-white, and soft, and crumbling.

Oxalate calculi are hard, brownish, spheroidal, nodular, of medium size, and usually of renal origin ; they are not rarely coated with phosphate, and occasion much cystitis, with haemorrhage.

Calcium carbonate stones are multiple, very small, white and hard.

Cystin calculi are small, waxy, yellowish, translucent and turn green on exposure to the air.

Xanthin calculi are very rare ; they are smooth and of a red-yellow color.

Indigo seldom occurs except in association with some other material.

Biliary calculi may be found in the bladder in cases of fistula.

**Situation.**—Most of the stones are found in the lowest part of the bladder (bas-fond); they may also be present in the neck, above the pubis, and behind the prostate. They may be either free or encysted.

**Conditions Favoring the Formation of Stone.**—Among these may be mentioned the following :

1. Diseases of the brain or spinal cord (paralysis of the bladder.)
2. Free use of animal food and malt liquors coincidently with excessive fatigue and profuse sweating.
3. Presence of foreign bodies introduced into the bladder from without.
4. Retention of urine from any cause.

*Clinically*, whenever we find residual urine we expect sooner or later to find stone in the bladder. That stone may form rapidly, *i. e.* within a few weeks, there is good reason to believe.

In one interesting case which the writer saw, that of a girl about ten years of age, a hair-pin served as a nucleus for an enormous phosphatic stone.

Etiological factors in the stone formation are supposed to be the drinking of limestone water, diet, hereditary predisposition, race, etc.

**Occurrence.**—Stone in the bladder occurs from foetal life to old age.

By far the larger number of cases occur in those under twenty. The writer, however, sees quite a number of cases in elderly men with long-standing cases of cystitis.

Many cases occur in children.

It is about thirty times as common in men as in women. Negroes are less subject to this disorder than the other races. It seems to be more common in certain localities than others. The writer's attention has been called to the comparative infrequency of calculous diseases in Savannah, Georgia, and to the frequency in the region around Chicago. Stone in the bladder is said to be infrequent in New England, but not uncommon in Ohio, Kentucky, Tennessee, North Carolina and Alabama. In Europe the same tendency to calculous disease exists in certain localities.

In India there are an enormous number of cases of this disease.

Children are more liable to uric acid calculi and old persons to phosphatic.

**Pathologic Anatomy.**—The muscular coat of the bladder becomes gradually hypertrophied from increased use, and its interlacing fibres begin to stand out in relief. A tendency to habitual contraction is established, due to irritation and intolerance of distention. The lining membrane of the bladder loses its normal salmon-pink color and becomes deep red, granular, or even villous, with occasional ecchymosis, and sometimes patches of yellowish surface-exudation. The bladder walls are thickened materially by the exudation also taking place in the submucous web of connective tissue around the enlarged follicles.

**Diagnosis and Clinical Features.**—The classical symptoms of stone in the bladder are the following:

*Pain* along the urethra, at end of penis, in the testicles or down the thighs.

*Sudden stoppage of the stream* (caused by the carrying of the stone by the flow of urine to the outlet of the bladder), accompanied by a twinge of sharp pain shooting along the course of the urethra and felt most acutely at the meatus.

*Frequency* of urination. Both pain and frequency are worse on motion.

Stone may, however, be present in the bladder without giving evidence of its presence during life.

Misplaced sensations are sometimes caused by the chronic cystitis of stone, the usual kind of pain being absent.

Children with stone habitually pull upon the prepuce, and, in general, the calculous patient habitually squeezes and rubs the under surface of the glans penis, just behind the frenum.

Rest upon the back, with the hips raised, relieves the pain of stone.

Uneasy sensations and sometimes acute pain are felt in the

rectum ; more or less dull pain above the pubes, radiating to the hips, sacrum, thighs and perinæum.

In a few cases calculi have been known to work their way out of the bladder through ulcerations involving all its coats.

**The Urine in Stone in Bladder.**—The urine is that of gradual inflammation of the bladder. At first, increase of mucus and epithelial *débris*, with deposits of crystals and a slight haematuria after rough or violent exercise or a jolting ride. Later, the urine of cystitis, with deposit of crystals and blood at the close of micturition, the haematuria being worse after motion.

In severe cases the urine may be very foul and tinged with blood, the pus sediment being surmounted by a layer of blood. Albumin may be abundant and the symptoms (severe chills, fever and prostration) suggest presence of pyelonephritis.

**Diagnosis.**—Stone being suspected from the symptoms and condition of the urine, the diagnosis is confirmed by sounding, the use of the cystoscope, or the X-ray apparatus.

The Röentgen ray very clearly showed stones present in one of the writer's cases, in which Dr. Adams operated and removed five stones, weighing in all 100 grains.

**Prognosis.**—The prognosis in vesical calculus depends essentially upon the general condition of the patient, his ability to undergo operation, and the kind of operation which is possible or necessary.

**Effects.**—These, in addition to the clinical features described, are hypertrophy of the bladder, pyelitis and pyelonephritis.

**Dangers and Complications in Cases of Stone in the Bladder.**—Abscess formation in the bladder and prostate ; outside of the bladder, in the neighborhood of the neck, from pericytis, and pelvic cellulitis, terminating in abscess ; in children both acute and chronic peritonitis, due to operations for relief.

The usual cause of death, when the patient is not relieved by operation, is pyelonephritis.

The association of malignant disease and stone is possible and should always be suspected if there is in addition to the symptoms of stone progressive loss of flesh in an elderly patient, and especially if there is much haematuria. The latter, however, may not be marked, even in cases where both stone and cancer occur together in the early stage of the latter.

**Treatment.**—*Preventive* treatment of stone has been considered under LITHURIA, PHOSPHATURIA, and OXALURIA.

*Palliative* treatment in cases not fit for operation consists of rest, milk diet, remedies previously considered under CYSTITIS for relief of pain, and, in the case of uric-acid stone, alkaline waters, Borocitrate of Magnesia in 10-grain doses two hours after a meal; in phosphatic stone the remedies already mentioned under PHOSPHATURIA.

Surgical treatment consists in removal of the stone either by the crushing or by the supra-pubic method. In this country the latter is chiefly used. In India the crushing operation is done on an enormous scale, many surgeons having used it more than five hundred times. Baker, of Hyderabad, reports 1,734 operations of lithotomy with a mortality of a little over one per cent.!

To prepare the patient for operation give Salol in five-grain doses, every three or four hours, until the urine is free from offensive odor. If the Salol causes darkening of the urine, it is to be given less frequently.

The early diagnosis and removal of stone is advisable before complications occur.

**Wounds.**—These may be from sharp instruments or objects, firearms and falls, especially upon the perineum. Pressure of the child's head, as in prolonged labor, may wound the bladder. If the peritoneal part is injured extravasation of urine takes place, quickly followed by septic peritonitis; in rare cases, however, the urine may become encysted. Surgical wounds usually heal if properly attended to. Contused wounds are a dangerous injury. The treatment is wholly surgical.

**Rupture.**—In rare cases over-distention has been known to burst the bladder, as in alcoholism. It may be due also to fracture of the pelvis, blows, excessive straining, injections or tumors. Rupture of the bladder occurs much more frequently in men than in women, and usually between the twelfth and fiftieth year. The symptoms are intense pain, a feeling as if something had broken or given way, followed by vomiting, faintness or collapse, and the symptoms of shock. A small amount of bloody urine is obtained by use of the catheter. The prognosis is unfavorable unless prompt surgical treatment is to be had.

**Supra-Pubic Cystotomy.**—The indications for this operation are the following :

1. Calculi and foreign bodies.
2. Tumors.
3. Tuberculosis.
4. Vesical haemorrhage.
5. Rupture.
6. Prostatectomy (certain cases).
7. For forming a fistula.
8. Severe cystitis.
9. As a preliminary operation in performing retrograde catheterization.

The operation is performed by different methods according to the necessities of a given case.

## CHAPTER XVII.

### DISEASES OF THE PROSTATE.

The conditions to be considered are malformations, atrophy, hypertrophy, congestion, inflammation, tuberculosis, tumor, cysts and calculi.

**Malformations.**—Unless there is some grave malformation of the genital tract, absence of the prostate is seldom noticed, but hyperplasia or congenital smallness may be present.

**Atrophy.**—This may be due to pressure of tumors in neighboring parts; it is also not unusual in old age.

### HYPERTROPHY OF THE PROSTATE.

**Etiology.**—The etiology of enlarged prostate has not been satisfactorily determined. Some degree of enlargement is found in about thirty per cent. of men who have passed the fiftieth year.

Different writers state its frequency differently. Riesman concludes that it is present in one out of three men who are past sixty. It may occur, however, much earlier in life. In extreme old age it is rare.

There is some connection between the process and the testicles, and it is probable that some alteration in the function of the latter may lead to enlargement of the prostate in old age. It is known that removal of the testicles quickly leads to atrophy of the prostate within a few days after the operation. Vasectomy, division of the vas deferens, produces the same result, though in a less marked degree.

**Pathologic Anatomy.**—The prostate reaches the maximum of its normal growth at about the fortieth year of life, when

it measures four to four and one-half cm. in width and two to two and one-half cm. in thickness, weighing sixteen to seventeen grammes. The hypertrophied prostate weighs from twenty-three to eighty-five grammes on an average, the largest known weighing two hundred and eighty-eight. The enlargement may involve one or both of the lateral lobes, the

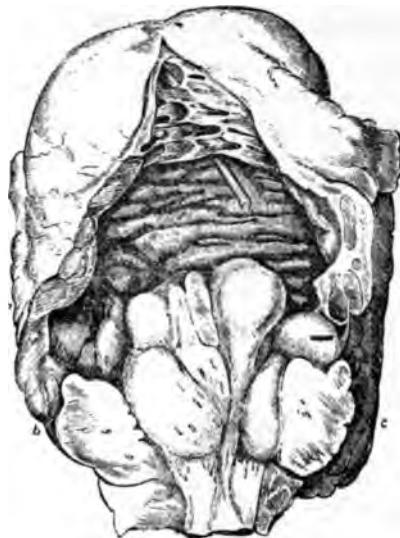


FIG. 30.—Section of bladder and prostate; the former hypertrophied, the latter forming prominent tumors within the bladder.—(From THOMPSON.)

so-called median lobe, or all three together. At the same time there is a characteristic change in the shape and width of the posterior urethra, into the lumen of which the median lobe often projects as a rounded hemispheric tumor, causing obstruction, or valve-like folds may be occasionally produced in the mucous membrane by the enlargement.

Section of the prostate shows it firm, whitish and dotted with brownish points—"grains of snuff" so-called. There is frequently a bulging of rounded masses which can be readily shelled out. (Riesman.)

The hypertrophied prostate presents a deformity as well as an enlargement, due to distinct tumors projecting toward or into the bladder and urethra.

**Pathologic Histology.**—Prostatic hypertrophy consists in an overgrowth of all the normal elements—fibrous, muscular and glandular—the first two predominating. In addition to uniform enlargement there is a tendency on the part of the first two elements to arrangement into distinct nodules of spherical form.

Usually section shows an abundance of stroma of muscular and connective tissue cells, with atrophy of the glands, the tubules having a low epithelial lining and a dilated lumen in which detached epithelia, detritus, and amylaceous bodies are found. In certain cases adenoma is suggested by marked glandular hyperplasia; in others, leiomyoma, like that of the uterus, by predominance of non-striped muscular tissue.

**Diagnosis.**—The finger in the rectum encounters a rounded, dense mass, either smooth and symmetrical or variously distorted and nodulated. The normal prostate is a soft, chestnut-like body, hardly recognizable except by the skilled touch.

**Clinical Features.**—In the earlier stages we find the following :

1. Difficulty in starting the flow of urine.
2. Feebleness of the stream.
3. Frequency of urination *at night* (due to venous congestion of the vesical neck).
4. Polyuria.

Later, when cystitis is established, we find :

1. Frequency of urination both by day and night.
2. Absence of feeling of satisfaction after urination.
3. Dull pain along the urethra.
4. Dribbling of urine, due to increase in quantity of the residual and overtaxing the sphincter.

**The Urine.**—In the earlier stages we find polyuria with urine of low specific gravity, and perhaps a trace of albumin.

As much as six or eight pints may be passed in a day, and the case may be pronounced diabetes insipidus.

When vesical catarrh appears we have the urine of chronic cystitis of varying degrees of severity.

**Differential Diagnosis.**—Hypertrophy of the prostate is to be differentiated from cancer of the prostate, tubercle of the prostate, urethral stricture, vesical calculus and tuberculosis, tumor of the bladder, renal calculus and tuberculosis. The leading diagnostic features of these disorders have already been given.



FIG. 31.—Section of bladder and prostate, showing marked but not great enlargement of lateral lobes and median portion.—(From THOMPSON.)

**Course.**—The disorder, as a rule, pursues a slow course, remaining, so far as the cystitis goes, mild for weeks or months, again increasing to an acuteness which confines the patient to bed. Retention of urine finally takes place in many cases, and the patient resorts to the catheter for the balance of his life or undergoes an operation.

**Effects of the Enlargement.**—The morbid conditions which result are the following :

Distortion of the prostatic urethra.

Elevation of the level at the vesico-urethral orifice.

Obstructions to the return of blood from the bladder.

As a result of these conditions a number of others sooner or later occur: dilatation of the bladder with increase of residual urine, hypertrophy of this organ and diverticula; dilatation of the ureters and renal pelves, with stagnation of urine, congestion and catarrhal inflammation of the entire urinary tract, tendency to calculus formation, pyelonephritis, and death from uræmia.

**Prognosis.**—This depends on the results of catheterization.

The essentials on which to base an opinion are the following:

1. The condition of the kidneys.
2. The condition of the arteries.
3. The general nutrition of the patient: weight, flesh, vigor, condition of the skin, digestion, excretion, occupation, and habits.

In a patient otherwise in good condition the catheter may be used successfully and comfortably for ten or fifteen years or more.

**Cause of Death.**—In a patient with polyuria, more or less albuminuria and cylindruria, indicating a low grade ureteritis and pyelitis, uræmia is not an uncommon cause of death, supervening after taking cold, or from over-exertion or imprudence in diet.

The symptoms of uræmia in such cases are as follows:

1. Hot, dry skin.
2. Loss of appetite.
3. Sleeplessness and restlessness.
4. Dry, red, or pasty tongue and parched mouth.
5. Depression, headache, and wandering of the mind.
6. Constipation.

Polyuria, with more albumin than the pus accounts for suggests renal disease, demands a guarded prognosis, and requires caution in treatment.

Hard and tortuous arteries with polyuria and cardiac hypertrophy are a serious coincidence, and in such cases the prognosis is bad as to time.

**Treatment.**—Removal of the cause by operative measures before retention from obstruction takes place is a principle of modern surgery. When for any reason such measures cannot be taken the essentials of treatment are as follows:

1. A nutritious dietary free from articles which irritate the prostate, especially beer and champagne.
2. Warm clothing and avoidance of cold or wet seats.
3. Warm baths, best taken at bed-time.
4. Regular urination in the upright position.
5. Careful attention to the bowels.
6. Relief from pain by remedies and suppositories.
7. Carefully regulated exercise in the open air.
8. Pursuit of vocation.
9. Avoidance of sexual excitement.
10. Catheterism for residual urine.
11. Medical and surgical treatment for cystitis and haemorrhage, if either or both exist.

The patient should not take too great an amount of fluids, and none at all in the latter part of the evening before bed-time.

The patient should be instructed to pass his water at regular intervals, and when obliged to urinate during the night he should rise from his bed and pass his urine in the upright position.

In clothing the patient, woolens, flannel abdominal binders, and thick-soled shoes with cork inner soles may prove serviceable. The patient should in general be well protected against cold and dampness, and when possible should be made comfortable with the dry warmth of an open fire.

For the liver the fluid extract of Taraxacum has been found by the writer to be of great utility in these cases. It may be used, as suggested by Dr. Späch, in combination

with Chimaphila and Corn-silk ; the formula is given below. Freyer thinks nothing is better for catharsis in enlarged prostate than confection of Sulphur or Senna, or equal parts of both. Alum, Licorice powder, the Sulphate of Soda, or one of the natural bitter waters, like Hunyadi or Hathorn, may be taken in the morning. If these fail to induce a daily bowel movement, enemata should be administered in the morning after breakfast. As the patient goes to stool he should throw into the rectum, just above the anus, a small injection of one drachm, half glycerine and half water. The syringe best suited for this purpose is a hard-rubber urethral syringe, with a nozzle an inch long. This will usually act immediately, producing a satisfactory and easily voided stool, without the unnecessary prostatic irritation which may attend the use of a large enema.

*Suppositories* for the relief of painful frequency may be mentioned as follows:

No. 1.

Iodoform, . . . . .	gr. xii.
Extract of Hyoscyamus, . . . . .	gr. viii.
Cocoa butter, to make 8 suppositories.	
Use one every three or four hours.	

No. 2.

Lupulin, . . . . .	5j.
Mono-bromide of Camphor, . . . . .	5j.
Cocoa butter to make 12 suppositories.	

No. 3.

Aristol, . . . . .	gr. xl.
Alcoholic extract of Belladonna, . . . . .	gr. ijss.
Cocoa butter q. s., 10 suppositories.	

In cases where there is severe pain which does not yield to the above, Laudanum or Morphine suppositories may be necessary, and sometimes Opium internally. It is well, however, not to give or use Belladonna in any form as long as the bladder retains any expulsive power ; No. 2 of the above or Morphine suppositories are better in such cases.

The best exercise is walking or carriage riding, but one of the writer's patients insisted that horseback riding made him feel better than any other form of exercise. This, however, was probably due to the fact that he had been accustomed to daily rides for years. In order to keep the mind occupied the patient should pursue as far as possible his regular vocation.

The catheter should be employed, according to Freyer, when in elderly men there is difficulty and frequency of micturition with some pain, the urine being turbid, possibly fetid, the patient looking ill and worn-out, and the hypogastric dullness pointing to the presence of a considerable quantity of residual urine. The employment of the catheter for the first time in these cases may be attended by severe constitutional disturbances. The examination should be made in a warm room, and the patient should be put to bed, and if constitutional disturbances set in, he should remain there longer than two or three days. The urine should be drawn off gradually, the bladder not being completely emptied for two or three days.

In an advanced state of prostatic disease of this kind the urine, even when clear and acid on the first introduction of the catheter, generally becomes cloudy and finally ammoniacal in the course of a few days, and constitutional symptoms supervene. A rigor will probably occur, or the temperature may rise to  $103^{\circ}$  or  $104^{\circ}$  F., profuse perspiration setting in. The normal temperature being reached, the fever may not recur. Sometimes more than one attack of this kind occurs, or the fever may continue for some days, gradually subsiding; but occasionally the patient sinks into a low typhoid state. If the kidneys are much affected, uræmia may set in, followed by coma, and may result in a fatal termination. The fever is termed "urinary," "urethral" and "catheter," but its exact cause is unknown. Its treatment is similar to that following instrumentation or operation for stricture of the urethra. (See URINARY FEVER.)

According to Freyer, habitual catheterization must be employed when the residual urine amounts to between three and four ounces. The catheter should be passed once in twenty-four hours if the urine amounts to four ounces or less, the best time being at bedtime. It should be used twice daily if six ounces are retained; three or four times daily if eight or ten ounces are retained. The catheter, when power of voluntary micturition is lost, should be used generally every four hours. In all cases the urine should be drawn off before pain or marked discomfort is felt, otherwise congestion of the prostate and bladder resulting in cystitis will be produced.

If, however, a patient has not more than from two to four ounces of residual urine, which is sterile, which is passed without pain or undue discomfort, which also does not get him up more than once a night, catheterization may well give place to internal treatment directed toward making the urine antiseptic, and to increasing the general circulatory tone. Of the drugs useful for this purpose, Salol, Urotropin, Ergot, Strophantus, Sandalwood oil and Saw Palmetto are most serviceable. For increased frequency of urination Hyoscamine sulphate will be found useful. When the retention reaches such a degree that the bladder is distinctly distended, even after micturition, which can be detected by a bimanual examination, a finger of the right hand being introduced into the rectum, while the left hand presses into the supra-pubic region, intermittent catheterization is absolutely indicated, even though the frequency of micturition is not so great as to be harassing. Under these circumstances a soft-rubber catheter is the instrument of choice. (*Therapeutic Gazette.*)

The patient should be taught the use of the catheter. The best instrument for habitual employment is a soft coudée, No. 7 to 9 E. It should be used by the patient while standing, unless he is very infirm.

The catheter having been introduced as far as the compressor urethrae muscle, the whole anterior urethra should be

flushed out with a mild antiseptic solution, preferably Boric acid, a drachm to the pint, by means of a fountain syringe. The nozzle of the syringe is introduced into the free end of the catheter. After this flushing, the catheter should be passed into the bladder. It is held perpendicularly while its end is introduced into the urethra, is then gradually depressed into the horizontal position as it glides along the canal over the obstruction and into the bladder, the curved end being directed upward toward the roof of the urethra. When the middle lobe is much enlarged, a bicoudée catheter or a well curved one terminating in an elbow may be necessary to overcome the obstruction.

This draining of the bladder should be practiced once or twice a day, until the patient is able to void urine every two or three hours. When he is unable to void urine, or passes it with great difficulty and in small quantity, the catheterization should be repeated every three hours. When, in addition to retention, there is infection of the posterior urethra and bladder, irrigation must be practiced each time the urine is drained.

In complete retention of urine, a vulcanized rubber catheter should be used. If this fails, a coudée catheter and a well curved one terminating in an elbow should be tried in succession. If these are unsuccessful, a well curved cylindrical gum-catheter without a stylet should be employed, which may be given any curve at pleasure by dipping it in hot water, and, after bending it, into cold water. Finally it may be necessary to employ a silver catheter with a longer curve.

In cases of enlarged prostate of long standing it may be found that before the bladder is fairly entered a preprostatic pouch is encountered.

When circumstances require the use of a metal catheter, the surgeon and not the patient should employ it.

Whatever instrument is employed should be kept scrupulously clean. Of the three kinds employed, the metallic and

the soft-rubber may be easily and effectually sterilized by boiling. Gum-elastic instruments are best cleansed by washing and syringing them through with soap and warm water. They should then be placed in a disinfectant solution for a short time, and, before used, also placed in Boric acid solution.

Before introducing an instrument into the bladder, the foreskin and glans should be well washed with soap and water and then swabbed with some weak antiseptic lotion. If there be any discharge from the urethra, the anterior part of the canal should be syringed out with warm Boric acid solution.

The catheter, after use, should be washed in soap and water by the patient, thoroughly dried, and placed for future use in a corked glass tube or covered dish. The best way to dry the instruments is to pass them between folds of lint or gauze, in which they may be kept until required. (Freyer.)

Cases are on record where men have used the catheter on themselves for twenty years or more.

After the first passage of the catheter the patient should remain warm and quiet preferably for an entire day.

The patient should take especial care to keep his feet warm and dry for the rest of his life after once using the catheter.

One or both testicles may swell during the use of the catheter. In most cases rest in bed on the back for a short time, use of bandage and tobacco-poultice or Antiphlogistine will relieve this condition.

The catheters may advantageously be kept in a sterile box containing formaldehyde, the vapor of which prevents them from becoming infected. Before using the instrument the patient should wash his hands with soap and water and, if possible, with a solution of Mercuric chloride 1:1000.

As lubricant for the instrument Freyer recommends fresh olive oil, or castor oil, or vaseline; carbolic acid should not be used. Guyon's pomade (equal parts glycerine, powdered soap and water, with one per cent. naphthol) is a clean and efficient lubricant. Inasmuch as fatty substances cause dete-

terioration of the rubber, the substance known as lubricondrin may advantageously be used, as it does not affect the rubber and is readily washed off with water.

When in spite of intermittent catheterization, carefully conducted, the infection seems progressive, the catheterizations are painful, the patient is teased by a constant desire to urinate without the ability to empty the bladder, and particularly when the gastro-intestinal disturbances, and perhaps lumbar pains and fever, point to renal inflammation, a speedy death is inevitable unless some more radical measures be undertaken.

Even under these circumstances, however, the patient can again be put in a condition of comparative comfort by continuous catheterization. This consists of introducing a catheter, preferably a soft-elbowed one, to a position just within the vesical sphincter, and tying it there. The end of this catheter is dipped beneath the surface of an antiseptic solution contained in a urinal, and the urine, as it runs into the bladder from the ureters, is at once drained out. At least twice a day the bladder is thoroughly irrigated with an antiseptic solution, using for this purpose either Boric acid, a drachm to a pint; Permanganate of Potassium, 1:6000; Nargol or Protargol, 1:6000 running up to 1:1000, or Mercurol, 1:2000, in a normal salt solution. The urethra should also be flushed twice daily by withdrawing the catheter until its eye lies just beyond the grip of the compressor urethrae muscles. Under this treatment, as a rule, the fever subsides, the pain is lessened and disappears in from one to two weeks. The urine again becomes clear, and intermittent catheterization may again be resumed.

It often happens, however, that there is a prompt recurrence of inflammatory symptoms. This indicates the need of a radical operation designed for the removal of the obstruction. (*Therapeutic Gazette.*)

The cystitis is to be treated as already described. (See

CYSTITIS.) The writer, however, finds certain remedies especially useful in the cystitis of enlarged prostate; these are first, *Urotropin*, in dose already given; *Chimaphila* and *Stigmata maydis*.

An excellent prescription in a palliative way is that originally suggested to the writer by Dr. A. B. Späch, of Chicago, as follows:

A mixture of the fluid extracts of *Chimaphila*, *Taraxacum* and *Stigmata maydis*, in the proportions by volume of 1, 2, 3, in the order named. The dose is a teaspoonful every three hours.

*Triticum* is sometimes substituted for *Chimaphila* in the above formula when the urine is scanty and there is swelling of the feet.

The *Taraxacum* in this mixture acts efficiently in many cases observed both by Dr. Späch and the writer, securing a daily passage of the bowels.

Further, if the urine happen to be strongly acid, *Citrate of Potassium* and *French Vichy Water* are exceedingly useful. If the above for any reason fail, lithiated corn-silk or hydrangea may be used.

*Triticum repens* in the preparations known as *Tritica* or combined with Saw Palmetto (tritipalm) have appeared to increase the urine and diminish smarting in some cases. Oil of Sandalwood and Saw palmetto (*Sanmetto*) has also great vogue in prostatic cases.

If *Urotropin* fails to clear the urine, *Boric acid* should be given internally, dose usually ten grains four times daily, increased to twenty-five in extreme cases. Before using *Urotropin*, the writer used the formula of Ralfe, given under PYELITIS, in cases when the urine was ammoniacal and foul.

Some cases are best relieved, according to Freyer, by *Boric acid*, combined with *Benzoate of Ammonium*, in 10-grain doses. *Salol* and *Salophen* are also useful as disinfectants. The former is used by Adams, before operations, in preference to *Urotropin*. (See STONE IN THE BLADDER.)

When there is much pus and foul, stinking urine, the bladder must be washed out with disinfectants, or astringent lotions.

Not more than two or three ounces should be thrown into the bladder at one time. If the cystitis be severe, not more than half an ounce should be used at a time. All lotions should be warmed to 100° F. To cleanse the bladder the most simple and useful injections are a one-per-cent. solution of boric acid or a teaspoonful of boroglycerin to four ounces of water. Permanganate of potash solution commencing with 1-in-5000 and gradually increasing it to 1-in-1000, and perchloride of mercury 1-in-10,000, make excellent injections. The sheet-anchor in such cases is nitrate of silver, commencing with a weak solution, 1-in-4000, gradually increasing this to 1-in-750.

For great pain and scalding at the neck of the bladder from local cystitis daily instillations of nitrate of silver are employed. (Freyer.)

One of the writer's patients reports much relief from washing the bladder every other night with dilute Permanganate solution which he prepares for himself as follows:

Cover a dime with permanganate crystals, dissolve in two quarts of water, warmer than the temperature of the body, and inject one quart in all into the bladder.

Another of the writer's patients who complained of burning and smarting in the urethra was made very comfortable by use of Urotropin internally and injections of oxychlorine solution. There was, however, not much cystitis in this latter case.

Hæmorrhage rarely occurs early, but is likely to take place in the later stages; the blood may come from either the bladder or prostate. The treatment consists in perfect rest in bed and the administration of sedatives or narcotics. Frequent hæmorrhage, attended by much pain after exercise in prostatic patients, should always give rise to the suspicion of the presence of stone.

In severe haemorrhages rectal injections of hot water, with or without brandy, are of great value if there is circulation enough to cause absorption by the bowel. In cases where the heart action is very feeble, venous transfusion of normal salt solution must be made. If for any reason this cannot be done, hypodermics of ether, in doses of ten minims every ten or fifteen minutes, until five or six doses have been given, may cause the patient to rally.

If the normal salt is used the solution employed should contain one drachm of salt to the pint, and must have a temperature of from  $101^{\circ}$  to  $102^{\circ}$  F. It will cool down to blood heat while passing through the transfusion apparatus. Care should be taken to see that the temperature is maintained during the operation, and this can most easily be done if the solution be prepared in small quantities at a time. It should in all cases be filtered through muslin before use. If it be necessary to repeat the transfusion, another vein must be opened. When the patient has been revived and the immediate danger of death from syncope is staved off, the extreme restlessness and headache that so frequently follow may be treated by large doses of opium or morphine. Any further tendency to syncope is best treated by raising the foot of the bed, and the administration of liquid food and stimulants in small quantities at frequent intervals. The great risk of subsequent sepsis must not be forgotten, and the convalescence of such patients is of necessity a slow process. (Freyer.)

**Treatment by Electro-Cataphoresis.**—Iodine is applied cataphorically from a solution of Iodide of Potassium, either through the rectum or through the urethra. The treatment through the rectum is not so severe as through the urethra. It requires skill and manipulative ability. The writer has seen a case which was considerably aggravated by this procedure. The methods are as follows:

After placing the patient in the proper position, the rectum

carefully cleansed, a speculum inserted and the prostate exposed, the medicament is carried to the prostate by means of a suitable electrode, covered with moist gauze, carbolated 5 per cent. and then soaked in the medicament. The time required for cataphoresis depends upon the condition of the prostate.

The treatment through the urethra is easily accomplished by using an applicator composed of a hard rubber tube closed at the distal end with a hard rubber plug; for about two inches from the distal end a number of small holes are drilled in the tube. A copper wire, to which the electrode is attached, is wound with absorbent cotton and dipped in the solution, then inserted in the applicator, which has previously been carried into the prostatic urethra. A current of 10 milliamperes is all that is necessary.

The solution of Potassium iodide must be applied from the negative pole, in order to get the resolvent effects of the iodine in the enlarged gland.

**Operative Treatment.**—Among the various operations proposed for enlarged prostate are prostatectomy, the Bottini operation, vasectomy and castration. According to Adams, the best general operation is *perineal prostatectomy*, and the time for operating is as soon as obstructive retention takes place. As a rule, the longer the patient uses the catheter the less fit he is for operation.

According to Reginald Harrison, in cases where the upper portion of the enlarged prostate interferes with urination by projecting into the trigone, the Bottini operation is most efficient.

The latter operation, if performed, should be done by an expert only, as it requires skill and practice. According to Bransford Lewis, many a feeble old man may be operated on by this means who would almost certainly be killed by other curative means, notably by prostatectomy. Many another, who suffers from urinary obstruction simply because of a

prostatic "collar" surrounding his internal urethral orifice, can be cured by this simple and innocuous procedure, free from large haemorrhage, open wound, an avenue for septic absorption and infection, continued surgical drainage through an artificial channel, the loss of tissues, etc., done with local, instead of general, anaesthesia, as well as he can be cured by the more heroic and radical measures.

The Bottini operation consists in making incisions in the prostate by means of a blade heated red-hot by electricity. It can be done by use of Cocaine instead of general anaesthesia. As a rule, active haemorrhage is absent, and usually the only complaint after the operation is a temporary increase in the burning on urination. In some cases, owing to the swelling incident to the operation, there may be complete retention; in such a case catheterizing is necessary for a time. According to Lewis, the after-treatment, aside from the invariable exhibition of the internal antiseptics, varies with the course of the case. If all goes well, there is practically no after-treatment except rest in bed for two or three days, light diet, and the securing of personal cleanliness. But in certain cases troublesome features arise, such as painful contractures at the vesical neck, coming on periodically, with the accumulation of urine in the bladder. This necessitates the giving of rectal suppositories at sufficient intervals to prevent them, or of hot water enemata, which have an exceedingly beneficial effect also. There is occasionally dribbling of urine for a few days, but this is rather gratifying than otherwise, indicating the removal of the obstruction and the retention that have so long dominated the scene. A porcelain urinal kept under the penis prevents wetting of the bed. The dribbling seldom lasts longer than a few days after a Bottini operation.

In a number of cases it has been noticed that the second or third day brings a sudden rise of temperature to 101 degrees or more; but it has also been noticed that this soon subsides and does not recur, whether special measures are undertaken to accomplish that end or not.

One after-effect that is disagreeable but which does occur sometimes, is continued haemorrhage from the prostatic urethra. It is nearly always easily controlled, however, by leaving a soft-rubber catheter *à demeure* for twenty-four or more hours. It is thought to be especially likely to occur with the spongy prostates, indicating the glandular rather than the fibrous form of hypertrophy.

The patient should drink freely of some good, pure water at this period to keep his urinary apparatus washed out as well as possible. To accelerate the urine flow Lewis suggests one or two tablespoonfuls of sugar of milk (*saccharum lactis*) in a glass of good water every two or three hours. It is a perfectly bland and unirritating diuretic.

Freeman (*Denver Med. Times*) sums up the advantages of the operation as follows:

1. "There is no mutilation and no external wound, the manipulations being carried out through the urethra.
2. A general anaesthetic, so dangerous in the old and debilitated, is not often necessary, local anaesthesia being usually sufficient.
3. There is very little haemorrhage, the vessels being sealed by cauterization.
4. There is comparatively small danger of serious infection, and usually but moderate rise in temperature, the wound being necessarily aseptic. The charred surfaces tend to prevent absorption until granulations appear.
5. In most instances patients may sit up and even walk about in a few days, which is of great advantage in those who are old and feeble.
6. The effects may be almost immediate, more or less urine being voided within a few hours, where it was previously impossible to pass a drop.
7. But few relapses have been observed; in fact, improvement has a tendency to be progressive.
8. The operation may be repeated, if for any reason the attempt has been unsatisfactory.

9. The mortality is lower than with other effective measures.
10. Patients will avail themselves of this method of treatment when they will refuse to submit to castration, prostatectomy, etc."

On the other hand, as suggested by Adams, there are certain objections to the operation as follows:

1. The operator is working in the dark.
2. The blade may bend during the operation.
3. There is difficulty in regulating the depth of the incision.



FIG. 32.—A healthy prostate from a man aged thirty-five years, with its posterior or rectal surface downward—the internal meatus being seen above, and the ejaculatory ducts in their depression below.—(THOMPSON.)

4. Accidents happen, such as burning into the rectum.

The operation should, therefore, be undertaken only by an expert, in whose hands it is undoubtedly serviceable in many cases.

*Perineal prostatectomy* may be performed by making the prrectal flap incision of Otto Zuckerkandl; this is a curved incision from one tuberosity of the ischium to the other in front of the anus by which the fascia are cut. The muscles are then separated and the rectum is separated from the urethra by dry dissection, and this reveals the capsule of the prostate from which the gland is enucleated.

**Hyperæmia.**—This occurs normally during venereal excite-

ment, and results, when the appetite is not gratified, in the secretion of a peculiar viscid mucus, which appears mixed with urethral mucus at the meatus. It is common in the case of continent men during the period before marriage, and requires no treatment save rest from sexual excitement, or a cold sitz-bath occasionally. The patient should be assured that the discharge is not seminal, which may be ascertained by microscopic examination.

In old urinary cases severe prostatic congestion sometimes takes place, resulting in complete retention of urine, and, unless the latter be drawn off, severe symptoms, suggesting pyelonephritis, may ensue.

**Treatment.**—*Thuja*, *Conium* and *Secale* are the principal remedies. In some cases, dependent on arterio-sclerosis, Iodide of Potash, thirty grains in four ounces of water, a tea-spoonful slightly diluted twice daily.

Alcohol, spiced foods, and long sitting, as in a buggy or railway car, or on a bicycle, are to be avoided.

Sexual excess, constipation and diseases of the rectum aggravate the condition.

#### ACUTE PROSTATITIS.

**Definition.**—Acute inflammation of the prostate.

**Varieties.**—Acute prostatitis may be either catarrhal, follicular or suppurative also called parenchymatous.

Follicular prostatitis is characterized by an obstruction of the follicles with the formation of small sacs containing desquamated epithelium, leucocytes and débris. It is, however, clinically chiefly chronic.

*Sppurative prostatitis* is the usual acute form. It is characterized either by the formation of small abscesses or by a diffuse phlegmonous inflammation, with, at times, complete destruction of the gland-tissue.

The prostate is at first congested, then inflamed; finally res-

olution takes place, pus exudes on the free surface or there is croupous exudation; abscess or peri-prostatic formation of pus may take place, or the disease linger indefinitely as a chronic follicular inflammation.

In cases of suppurative peri-prostatitis, thrombosis of the veins of the prostatic plexus is likely to take place, and softening of the thrombi not rarely gives rise to septic embolism and general pyæmia. The abscesses may burst into the urethra, or the suppuration may end in fibrosis of the prostate, with gradual atrophy.

**Etiology.**—Rarely a primary disorder. We find it secondary to the following conditions:

Gonorrhœa.

Stricture.

Irritation from various causes: acid urine of high specific gravity, use of instruments, fragments of stone, strong injections, drugs, like Cantharides, internally.

It is claimed that riding the bicycle causes acute prostatitis, but, in the writer's experience, those patients who have referred their trouble to this cause have obviously done so in order to conceal the history of a previous gonorrhœa.

Sexual excess, constipation and rectal disease are predisposing causes.

Prostatitis occurs also in infectious diseases, small-pox, pyæmia, glanders and typhoid fever.

The bacteria concerned in it are chiefly the pyogenic cocci, the gonococcus and the *Bacillus coli communis*.

**Clinical Features.**—These may be summarized as follows:

Rapid swelling of the prostate, which, to the finger in the rectum, may feel as large as a small orange.

Exceeding sensitiveness of the organ to the touch, which excites immediate desire to urinate.

Feeling on part of the patient of something protruding into the rectum, causing in some cases ineffectual attempts at stool.

Heat, weight and throbbing sensations locally.

Various other symptoms or sensations, as dragging pain in back or limbs.

Diminution of urethral discharge to a greater or less degree for the time being.

Constant desire to urinate without sense of relief, and with pain as the last drops pass, when the circular fibres at the neck of the bladder squeeze the tender prostate.

Febrile disturbance.

Great mental disturbance, out of proportion to the magnitude of the disorder. Mild acute mania, even, occurs in some cases.

Not infrequently the abscess opens in two directions, giving rise to fistulæ, which, if unrevealed, render the life of the patient wretched beyond description.

**Prognosis.**—The degree of fever is a valuable criterion on which to base an opinion. If the temperature does not rise above 101° F., and is unaccompanied by chills, sweating and prostration, resolution without suppuration will probably occur.

Resolution, when occurring, takes place between fourth and twelfth day; recovery in from one to three weeks.

*Unfavorable* signs are marked chills, high fever, and considerable diminution of perineal pain and tension, indicating suppuration instead of resolution. If the abscesses are small the prognosis is still good, but where the collection of pus is very extensive the prognosis must be guarded.

**Treatment.**—The essentials are the following:

1. Absolute repose in bed with a non-nitrogenous diet.
2. Alkaline waters, as Vichy.
3. Morphine in quantity just sufficient to control severe pain and excessive action of the bladder.
4. Copious enemata of hot water for the bowels. No cathartics, unless necessary; then give Castor oil.
5. Suppositories, as of codeine, gently introduced, to modify the incessant desire to urinate.

6. In severe cases leeches to the perinæum, followed by hot sitz-baths and hot rectal enemata, repeated three or four times daily.

Or the measure advocated by some German surgeons of application of cold direct to the prostate by use of a rectal sound and stream of iced water.

A case is reported in which the pain and sense of weight were relieved by a galvanic current of from five to seven milliampéres, the positive pole being placed in the urethra and the negative over the perinæum.

The remedies usually indicated are *Bryonia*, *Mercurius*, and *Pulsatilla*. *Bryonia* and *Pulsatilla* in drop doses of the tincture every two hours. *Mercurius solubilis* in the first trituration, four grains in seven ounces of water, a teaspoonful every two hours.

*Gelsemium* and *pichi* in the lower decimals may also be needed.

#### PROSTATIC AND PERI-PROSTATIC ABSCESS.

During the course of acute prostatitis pus formation is shown by the symptoms already described under PROGNOSIS. The pain is less tense and of a more lancinating character. Retention of urine may result from pressure in the already narrowed urethra.

Less marked and less intense symptoms are found in peri-prostatic cases. (Œdema felt by the finger in the rectum serves to distinguish peri-prostatic abscess.)

Treatment.—If the abscess bursts spontaneously, all pain and discomfort cease like magic. But, owing to the dense nature of the fibrous capsule of the prostate, it is often tardy in opening.

When fluctuation can be made out through the rectum, puncture with a trocar is to be made.

When the bulging into the urethra produces retention

without yielding fluctuation, pneumatic aspiration of the abscess through the rectum is advised. Or aspiration several times daily above the pubes to draw off the urine; or careful attempts to relieve the bladder with a silver catheter.

#### CHRONIC PROSTATITIS.

Chronic prostatitis may be, (*a*) strictly follicular, (*b*) follicular and parenchymatous combined, or (*c*) tubercular.

**Etiology.**—Chronic follicular prostatitis usually follows acute gonorrhœal prostatitis. It may also come on insidiously after gonorrhœa without previous acute disease of the prostate.

**Pathologic Anatomy.**—The disease involves the mucous surface of the sinus of the prostate and of the mucous follicles and ducts. There is a discharge of a more or less viscid secretion, containing desquamated epithelium, leukocytes, amyloseous bodies, Böttcher's crystals, and peculiar casts somewhat resembling tube-casts of the hyaline variety. The prostate may be smaller or larger than normal and is either soft and dirty-brown in color, or fibroid and glistening. Microscopically, we find the lumen of the tubules filled with the epithelia, leukocytes and amyloseous bodies mentioned above and about the glands are leukocytes and newly formed spindle cells.

Cicatricial bands by contraction may either occlude the ejaculatory ducts or tend to keep them patulous and thus cause spermatorrhœa.

**Clinical Features.**—These are the following:

Slight muco-purulent oozing from the meatus, increased by straining at stool (prostatorrhea).

In some cases painful defecation.

In the combined cases of chronic follicular and parenchymatous disease we have the following:

Weight and dragging-down sensation toward the perinæum, with painful feeling in the prostate.

Painful sensation when walking.

Increase of pain on crossing the legs; finally also from sitting, or in changing from sitting to standing, and *vice versa*.

The symptoms and urine of stone in the bladder.

Great mental depression.

The finger in the rectum finds slight enlargement and heat of the prostate, with perhaps increased sensibility, and sounding finds the prostatic urethra exceedingly sensitive without presence of stone in the bladder.

**Treatment.**—Keyes advises repeated mild blistering of the perinæum for weeks, if necessary, by painting cantharidal collodion upon one side of the perinæum, confining the patient to bed for forty-eight hours, and painting the other side of the raphé as soon as the soreness of the first begins to subside. Great care is necessary to avoid the scrotum and anus in this procedure. Binding up the scrotum and covering the blistered surface is necessary.

Nutritious diet, alkaline waters, and free movements of the bowels are necessary.

Phosphoric acid and Phosphate of Strychnine are the chief remedies internally.

*Massage of the prostate* is now much used in the treatment of chronic gonorrhœal prostatitis. Lydston, of Chicago, recommends the following procedure :

The latero-prone position, with the buttocks upon the edge of the table so as to be easily accessible to the operator, and the knees well drawn up toward the chest, is most satisfactory. It is as difficult to instruct the inexperienced in the technique of prostatic massage as it is to describe the sound of a violin. Much depends upon the tactile sensibility and education of the finger. In a general way, prostatic massage requires that not only the prostate proper, but the peri-prostatic tissue should be stroked and rubbed with the pulp of the finger towards the median line, and forward toward the operator. The seminal vesicles, prostate and peri-prostatic tissue at the neck

of the bladder represent an equilateral triangle, the apex of which corresponds to the apex of the prostate, and the base to a line drawn between the upper extremities of the seminal vesicles. The massage should be applied obliquely toward the median line and apex of the prostate. As a rule, all of the tissues within this triangular area should be thoroughly massaged. The amount of pressure depends upon the tolerance of the patient, the sensibility of the prostate, and the chronicity of the inflammation. It should be gentle at first, and gradually increased *pari passu* with the increase in the tolerance of the patient.

The frequency with which massage should be administered necessarily depends upon circumstances. Some patients tolerate the operation daily with manifest advantage. Comparatively few, however, tolerate it oftener than every other day, and in by far the majority of cases twice weekly is best. The massage may be combined with through and through irrigations of various antiseptic solutions, of which the Permanganate of Potassium, Nitrate of Silver, Albargin and Sulphate of Copper are the most useful.

## TUBERCULAR PROSTATITIS.

**Etiology.**—It is most frequent in young adults who are tuberculous or debilitated. It is generally a part of urogenital tuberculosis, but may be primary from hematogenic infection.

**Pathologic Anatomy.**—The prostate is enlarged and usually cheesy degeneration is the feature; more rarely then are typical miliary tubercles. The caseous sacs may rupture into the rectum, urethra or bladder, and, in rare instances, a general miliary tuberculosis is produced.

**Clinical Features.**—These are the symptoms of severe chronic prostatitis:

The contour of the prostate felt per rectum is lumpy.

The course of one or both vasa deferentia can be traced as an infiltrated hard tube, joined to a distinctly enlarged, knotted, indurated seminal vesicle.

Steady aggravation of symptoms is noticed.

Slight haemorrhages take place from the urethra from time to time without relief.

There are tubercle bacilli in the urine.

**Course and Prognosis.**—The course is exceedingly slow and the prognosis bad.

**Treatment.**—Occasionally cures are effected by the usual anti-tubercular measures of hygiene, diet, climate, and medication.

#### CARCINOMA OF THE PROSTATE.

This is exceedingly rare and often overlooked. The growth is of the nature of adenocarcinoma.

**Etiology.**—It may occur in youth, but is usually observed in advanced age. It may be engrafted upon antecedent hypertrophy. In a case observed by the writer, that of a man seventy-five years of age, the condition was that of ordinary hypertrophy for five years, prior to the development of carcinoma.

**Pathologic Anatomy.**—The appearance is that of simple hypertrophy, which may be as large as a hen's egg, nodular and very hard; or there may be large, well-defined tumors. Occasionally the surface of section is suggestive of tuberculosis. There is marked tendency to metastasis, and the extent of the secondary growths is out of proportion to the size of the primary tumor. Metastasis occurs early to the inguinal lymph-glands; also to the retroperitoneal and pelvic glands, and to those along the aorta and vertebral. There is frequent metastasis to the bony skeleton, the secondary growths being characterized by formation of osseous tissue, hence the term osteoplastic carcinoma. There may be also metastasis to the

liver and the rectal wall may be infiltrated and adherent to the tumor.

**Post-Mortem Appearances.**—In Madison's case these were as follows:

Post-mortem showed a scirrhus of the prostate gland about as large as a hen's egg, nodular and very hard. The peritoneum was also infiltrated with cancerous masses. There was also a small secondary cancer of the liver, some portions of which had undergone calcareous degeneration. The bladder contained about one ounce of purulent liquid, evidently partly urine, partly pus. The mucous membrane at the base of the organ, while extremely red, could hardly be said to be ulcerated. A more correct description of it would be conveyed by the term granular inflammation. The rectal wall was infiltrated by the growth and was adherent to the tumor, although rectal symptoms were surprisingly few and slight, being practically limited to pain on defecation.

**Clinical Features.**—These are the following : Free haemorrhages from the urethra, either spontaneous or during urination, with relief to the symptoms and pain ; the discovery of shreds of tissue of considerable size in the urine ; if scirrhouc cancer, the peculiar hardness of the prostate felt per rectum ; if medullary, certain spots softer than others in the prostate ; enlargement of the glands in the groin and pelvis.

The most prominent symptoms are frequent desire to urinate, pain upon defecation, and intense pain in the region of the bladder and prostate gland, emaciation, and loss of appetite.

Cancerous cachexia is slow in appearing ; in the case observed by the writer it was postponed until a month or two before death.

**The Urine.**—This may show the features of previous hypertrophied prostate or may, according to Madison, be normal so far as chemical analysis goes.

Madison observed a growth no larger than a hen's egg,

which had not ulcerated, and which caused no pressure-symptom whatever excepting inability to urinate. The urine, to within a few days of death, remained entirely normal as far as chemical analysis showed. The microscope only showed a small amount of mucus from the bladder. There was never any rectal discharge, and the post-mortem showed no breaking down of the tumor. And still the growth caused death.

**Prognosis and Treatment.**—The prognosis is bad and the treatment practically *nil*. In Madison's case the patient had to have, during the last three weeks of his illness, four grains of Morphine, hypodermically, every four hours, and this amount did not produce complete narcosis, the effect lasting only from two to three hours. A hypodermic needle was used on this case something over one thousand times.

#### OTHER TUMORS.

*Sarcoma* is rare. It may be of the round-cell or spindle-cell type. It may spread locally, but, as a rule, does not involve the lymph-glands. Metastasis is usually to the lungs or liver, rarely to the bones.

*Cysts* are due to obstruction of the gland-ducts or to dilatation of rests of the Müllerian ducts. In rare cases cysts of echinococcus occur.

#### CONCRETIONS OF THE PROSTATE.

The corpora amyacea may coalesce and by incrustation with lime salts be transformed into calculi chiefly phosphatic. They are exceedingly hard, with a polished surface. If large, they may lead to prostatic obstruction and cause chronic cystitis or atrophy. If they project into the urethra, a metallic instrument may be felt to grate on them. If they cause distressing symptoms, Keyes advises perineal opening and extraction.

## CHAPTER XVIII.

### DISEASES OF THE URETHRA.

*Malformations* of the urethra are as follows: Absence, congenital stricture, epispadia, hypospadias, doubling, and congenital fistulas.

**Wounds and Ruptures.**—False passages may be produced by the passage of instruments. Surgical wounds heal readily without stricture, when longitudinal, but transverse wounds lead to formation eventually of stricture. Accidental injuries may be due to passage of foreign bodies and to external violence. Subcutaneous rupture is most common in the perineal portion and results in extravasation of urine; rupture may take place in the case of women during labor.

According to J. R. Hayden, when there is marked hæmorrhage with retention, or bloody urine associated with inability to enter the bladder with instruments; also, if there is a fluctuating perineal tumor with, perhaps, a rise in temperature, perineal section and bladder drainage are indicated. In other cases, catheterization, irrigation, and urinary antiseptics should be resorted to, and watch kept for the first sign of urinary extravasation, in which event external urethrotomy with vesical drainage should be resorted to. Partial suture of the urethra should be employed when the divided ends are widely separated. Complete suture is, in general, contraindicated.

**Hæmorrhage.**—This occasionally takes place after coitus; it is more commonly due to injuries and inflammations. If from the anterior urethra, blood may be squeezed out of the meatus by pressure with the fingers.

It may take place in severe cases of gonorrhœa, in impacted calculus of the urethra, and after use of the catheter.

**Stricture.**—This is due either to gonorrhœa or wounds and injuries. In the latter case the stricture appears soon after the injury, but in the former usually not before a year after the acute attack. Stricture may result in dilatation of the urethra and of the neck of the bladder behind the stricture, in prostatitis, hypertrophy of the bladder, and often cystitis, ureteritis and pyelonephritis. Periurethral abscesses and urinary infiltration are not uncommon results.

**Tuberculosis.**—In descending urogenital tuberculosis, the urethra may be involved, usually the prostatic portion, but sometimes the whole urethra; or urethral tuberculosis may be an extension from tuberculosis of the penis. In women lupus of the vulva may implicate the urethra.

**Syphilis.**—Chancre, chancroid, and gumma are possible in the urethra. *Leprous* lesions sometimes occur.

**Tumors.**—*Cystic* and *papillomatous hyperplasias* occur more commonly in women, but in general are rare.

*Carcinoma* is rare but may occur in old age in the form of squamous epithelioma. Adenocarcinoma may develop from Cowper's glands.

The growth may be secondary by extension from the glans or the prostate. *Sarcoma* is exceedingly rare and usually secondary, by extension from the penis.

**Calculi and Foreign Bodies.**—Calculi may be found lodged in the urethra behind strictures and coming usually from higher up in the urinary tract.

These may reach a large size. A lump is found in the perineum which use of the sound shows to be stone in the urethra. P. M. Ashburn, of Batavia, Ohio, found one of unusual size, shown in the figure.

It was  $2\frac{1}{8}$  in. long and  $1\frac{1}{4}$  in. in diameter. It was white on the inside, very hard, shaped and looked much like a potato. It weighed dry 660 grains. At one end of it was a polished surface that corresponded with a similar surface on the smaller stone, which lay against it. This second stone

was of the same appearance, shaped much like a Lima bean, and weighed dry 60 grains.

Jopson, in *American Journal of Medical Sciences*, reports two cases of *impacted calculus in the urethra of children*. The first, a boy of three, had difficulty in urination for about two weeks. For 28 hours before admission he passed no urine, and had been very restless. The abdomen and scrotum and thighs were swollen and tender. A diagnosis of urinary extravasation was made, probably due to rupture from impacted calculus. At operation a small red, rough stone was found in the spongy urethra. The child did well for three days, and then developed an attack of what was apparently scarlet



FIG. 33.

fever. It improved and then grew worse and died in collapse. The second patient, a boy, three and one-half years of age, had complained of pain over the bladder and passed no urine for 24 hours. When a catheter was passed, a stone could be felt in the urethra. Median urethrotomy was performed and a smooth round stone removed. The patient recovered satisfactorily. Jopson believes that the retention is usually reflex in character. The operation is often difficult.

A great variety of *foreign bodies* may be introduced from without. (See works on Surgery.)

In cases of necrosis of the pelvis, spicules of bone have been known to lodge in the urethral canal.

## INFLAMMATIONS.

A common complication of gonorrhœa is posterior urethritis, occurring in from sixteen to eighty per cent. of the cases, according to different authorities.

## POSTERIOR URETHRITIS.

**Definition.**—An inflammation of that portion of the urethral mucous membrane between the bulbo-membranous portion and the bladder.

**Occurrence.**—In males any time after the third week of an attack of gonorrhœa.

**Clinical Features.**—These are the following in the more severe cases :

1. Great frequency of urination, great urgency, and painful tenesmus.
2. Radiating pains and free haemorrhage at the close of micturition.
3. Heightened reflex sexual irritability and abnormalities of the sexual function.

**Diagnosis.**—This is made by the two-glass test of the urine. The patient passes his urine into two glasses : the first portion represents the urine of the bladder plus the washings of the urethra ; the second that of the bladder only. If no disease of the bladder or kidneys is present, pus in the second glass always means posterior urethritis. The examination should be made after long retention, and also again after a short retention. After short retention, if the second glass is clear, cystitis is excluded.

Pyelitis must be excluded by absence of the features of that disease, which have been already mentioned. The age of the patient and the history of recent gonorrhœa usually serves to distinguish the two. Considerable albumin is often

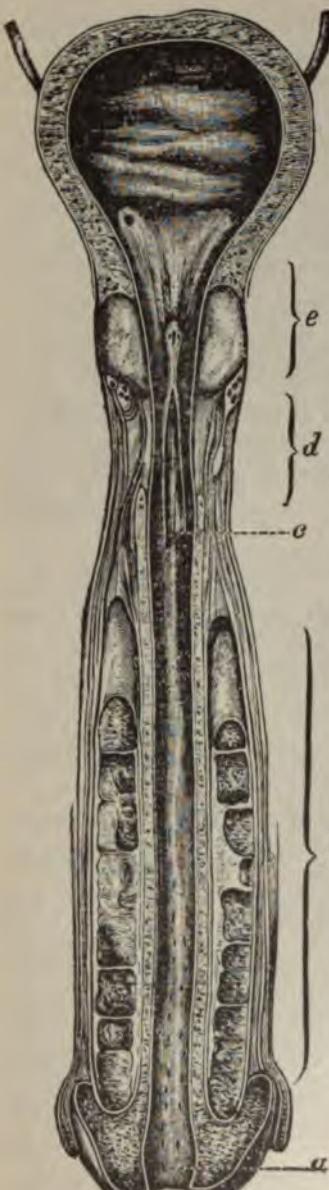


FIG. 34.—The male urethra, *a*, fossa navicularis; *b*, cavernous portion; *c*, the bulb; *d*, the membranous portion; *e*, prostatic portion.—(From FINGER.)

found in severe cases of this disorder, which may lead the physician to suspect renal trouble which does not exist, other than what is probably a renal congestion.

**Prognosis.**—Complete recovery from gonorrhœa complicated by posterior urethritis is uncertain. There is possibility of extension to the bladder, seminal vesicles, and testicles.

**Treatment.**—In acute cases avoidance of stimulating and salty foods, alcoholic beverages, etc., as in acute cystitis. The remedies already mentioned under Cystitis are of service. Chronic cases require surgical treatment (irrigation), and often resist treatment entirely. In obstinate cases cauterization is sometimes employed.

The writer has seen cases which were aggravated by surgical treatment improve considerably when irrigations were stopped.

*Frequency of urination with pain* is sometimes due to disease of the deep urethra, mistaken for cystitis or irritable bladder.

The morbid condition is usually confined to the mucous membrane and submucous tissues. In almost all cases there is a heightened color of the mucous membrane, varying between a

rose pink and slight purple, some cases presenting a granular surface. The diseased part will often bleed on touch. There may be, and usually is, some uneasiness about the base of the bladder, and when the desire to urinate is decidedly present, the discomfort is marked, nagging, and exceedingly uncomfortable. (Hawes.)

The endoscope is of service in making the diagnosis. The diagnosis having been settled, an ordinary urethral speculum of a caliber as large as can be borne with comfort should be passed through the deep urethra. With absorbent cotton on a cotton-carrier the mucus at the bottom of the speculum should be taken up, and if any blood has filled the lumen it should be mopped away until the mucous membrane is dry. Another carrier, having a small ovoid of cotton on its point, nearly saturated with guaiacol, may be used to make applications to the congested membrane.

Guaiacol in a fluid condition should not be permitted to cover the mucous membrane; barely enough to make a surface application is all that is desirable; thus applied it is an anæsthetic and mild stimulant. It gives rise to much less pain than the usual local applications. No strangury results, as is usually the case when silver nitrate is used. The patient will often retain the urine for hours after the application. Its use is often followed by a lessening of the perineal and suprapubic discomfort after a few hours, and a few applications, from five to ten days apart, have been more satisfactory to patient and physician than any remedy previously used. It has cured twenty per cent. of Hawes' patients. About seventy per cent. of the cases are improved markedly. Some cases that would seem to fall fairly within our field are not improved. If applied every day or two it will produce local tumefaction, causing a diminished size of the urinary stream; this tumefaction passes away in a few days. (Hawes.)

## URETHRITIS.

If the suppuration is in the urethra anterior to the compressor urethræ, there is never tenesmus or any uncontrollable desire to urinate, but merely a severe smarting sensation as the urine passes along the urethra. In acute urethritis the mouth of the urethra is usually swollen and reddened.

**Treatment.**—Catarrhal urethritis is usually of but short duration, and often disappears in a few days, if the causes of it, as catheterizing, masturbation, etc., are removed.

**Gonorrhœal Urethritis** begins about three days after exposure, and in uncomplicated cases the patient begins to improve by the twentieth day, whereas non-specific urethritis seldom lasts over twelve.

Microscopic examination for the gonococcus is necessary for differential diagnosis.

The treatment of gonorrhœa cannot be considered in full here, owing to the magnitude of the subject. The essentials are as follows:

1. Diet and hygiene.
2. Administration of alkalies.
3. Use of indicated remedies.
4. Local treatment by injections.

Unirritating diet free from alcohol, spices and acids, abstinence from tobacco and sexual excitement, rest, if possible in bed, are all useful. The urine should be kept alkaline with Potassium Citrate or Acetate or a mixture of both. Aconite, first decimal, and Gelsemium tincture should be given early in the disease, followed on the second or fourth day by Cannabis sativa and Argentum nitricum. Later Copalva and Sandalwood, in the second or third week and in appreciable doses.

According to Carleton, "during the first week of the disease prescribe a urethral injection after each urination, to be

retained three minutes, of 1 to 2 drachms of a  $\frac{1}{4}$  of 1 per cent. solution of Protargol. The second week alternate the protargol solution with a warm 1-4000 solution of permanganate of potash; in the third week discontinue the protargol and alternate the permanganate with a 1-1000 solution of zinc sulphate, each ounce of the zinc solution to contain one drachm of Lloyd's hydrastis. If the discharge continues after this period, use the zinc solution in increasing strength up to 3 grains to the ounce, three times daily until cured. Local lesions and complications will require their special treatment. If congenital effects are present, or are acquired, they must be surgically removed before a perfect cure can be expected.

If the posterior urethra becomes involved, local medication must be discontinued, with the possible exception of instillations every second day of a few drops of a 1-1000 to 1-500 solution of nitrate of silver. These applications are best made with the Taylor syringe and a No. 11 F. catheter, cut eight inches in length, the eye of which, when fully introduced, will be in the prostatic urethra. The catheter should be lubricated with lubrichondrin, and while it is being slowly introduced, a few ounces of a hot boric acid solution should be discharged through it into the canal to wash the latter free from infected matter and prevent carrying it to the deeper parts. Hot sitz baths and rectal irrigations, using 2 quarts of a 3-10 of 1 per cent. Saline solution or filtered camomile tea, often give much relief. The remedies found most efficacious in addition to those mentioned are Piper menth., Picric acid, Petroselinum, Buchu, Gelsemium, Mercurius, Cantharis, etc. (See note on Argyrol, last chapter of book.)

In some cases in which I have been unable to relieve by the indicated remedy I have used with immediate results a shot-gun prescription recommended by the late Dr. E. M. Hale, which is as follows:

Balsami Copaeae, Olei Santali, &c . . . . .	$\frac{3}{3}$	ss.
Olei Cinnamomi . . . . .	i.	
Emulsi Acaciae . . . . .	$\frac{3}{3}$	iiiss.
Elixirii Simplicis ad. . . . .	3	vi.

Sig.: Two teaspoonfuls every four hours.

The immediate relief which it has given is sometimes astonishing as well as particularly satisfactory."

In chronic cases, so-called gleet, the writer has seen some remarkable results follow the administration of an English mixture known as Liquor Santali cum Buchu et Copaiba. Its effect on the digestion may be unpleasant, but its curative action outweighs this effect.

*Urethritis in women* is often a very troublesome disorder and may be mistaken for cystitis. Gramm in chronic cases recommends application of stronger solutions of Silver salts or urethral injection of Antinosine, 2 per cent. twice daily.

#### URINARY FEVER.

**Synonyms.**—Catheter fever, urethral fever. It has also been called urinary poisoning, uræmic poisoning, and urinary infection.

**Definition.**—The febrile disturbance and accompanying phenomena, due to use of instruments on the urethra or bladder or to surgical operations on the urinary organs, or to impressions brought to bear on the same, *when the urinary organs are free from disease*.

Cases due to septic infection are not considered under this head, nor are cases in which some previous urinary disease has existed.

**Etiology.**—The cases are usually due to the passage of a sound, or catheter, but have been known to follow even the insertion of a bougie. They occur, however, very rarely. Many surgeons have never seen a case of this disease.

Velpeau reported some cases in 1873 and Keyes has seen a number of them.

**Pathology.**—The writer's theory of these cases is as follows: In considering the various phenomena which may result from even the gentle passage of a smooth sound through

the urethra, we must remember, first, that the penis is essentially a sexual organ, having a large and readily excitable nerve supply, hence easily susceptible to shock, with its resultant partial arrest of the heart's action, occasioning a corresponding failure in the circulation of the brain, and thus producing unconsciousness for a short time. This explains why men sometimes faint after the passage of the sound.

Second, it must be borne in mind that the kidneys are peculiarly susceptible to any violence done to the urethra, and a shock to the nervous system, due to the extreme excitability of the urethral nerve-supply, will result in a greater impairment of the nerve-supply to the kidneys than to other organs, and will cause a disturbance of the vascular supply of the kidneys, and usually an acute congestion of these organs. Now in kidneys previously nephritic an acute congestion may indeed cause death from acute uræmia, supervening on chronic, in a short time. But in those cases of urethral fever, where the kidneys are not previously nephritic, it is difficult to understand why death from suppression takes place so rapidly, for, according to Bouchard, the average man should live fifty-two hours after simple suppression of urine takes place, and, as is well-known, patients not having urethral fever sometimes live for days without passing any urine. It is then, in the case of previously healthy kidneys evidently not simply a question of suppression of urine but a more complex one.

According to Rachford, xanthin and paraxanthin are present in the scanty urine of sudden and severe cases of acute renal hyperæmia, and it is possible that in the acute hyperæmia, due to urethral fever, these or other toxic agents are suddenly present in far greater amount in the blood than we know anything about. It has been observed that a hot bath is one of the best means of restoring the renal function in cases of urethral fever, and that after urinating in it the patient may recover. Similarly favorable results have been noted

following hypodermics of Pilocarpine 1-10 to 1-5 of a grain. So that, in some cases at least, the condition would appear to be one of toxæmia, not that due to urea, potassium salts, or other normal constituents of urine, which, when not eliminated, cause death more slowly than happens in cases of urethral fever, but rather to a sudden and unexplicable increase in the amount of other toxic agents in the blood, as, for example, the xanthin bases, caused by the shock to the nervous system in general, and to reflex action on the kidneys in particular with its resultant effect on the blood.

Fenwick believes that in all cases of total suppression following passage of sounds or the catheter, all the essentials for the catastrophe are present but latent, and that the individual has been subject previously to attacks of congestion. Morris also believes the kidneys to be the cause of the suppression, the lesions varying from congestion through interstitial nephritis to abscess, but even supposing these ideas to be true, it is difficult to understand why the suppression results so speedily in death unless some toxin in increased quantity is suddenly present, the nature of which we do not understand.

**Clinical Features.**—After passing a catheter, or sound, or after some other manipulation on the lower urinary tract, in from a few minutes to several hours' duration the patient is suddenly seized by a chill; from that to a violent rigor accompanied by vibrations of the limbs and body, chattering of the teeth, with a rapidity similar to that of an electric battery, pain in the back and limbs, cold perspiration, a sense of fatigue or complete exhaustion. The temperature rises rapidly, from three to five degrees or more, accompanied by headache, injection of the conjunctiva, nausea, vomiting, dyspncea and cardiac irregularity, with delirium. The pulse becomes rapid, hard and tense. After a time, a pronounced perspiration succeeds, lowering the temperature, accompanied with more or less relief to the patient; pulse grows less fre-

quent and tense as the fever abates ; but the thirst still remains intense.

In from six to twelve hours the fever subsides, leaving the patient in a weak condition ; in cases where there is a definite lesion the attack may be repeated ; otherwise the patient rapidly resumes his normal condition, and convalescence is established in a few days. (Harbour.)

Suppression of urine may take place with convulsions and death in from six to forty-eight hours. If the urine is not suppressed, there is deficiency of urea, more or less blood, albumin, which is sometimes abundant, and in severe cases casts as well.

**Treatment.**—The patient should at once be put into a hot bath and a hypodermic of Pilocarpine hydrochlorate, one-tenth of a grain administered. The fact that patients thus treated have been known to recover, after urinating and perspiring freely, gives color to the writer's theory that a special toxæmia is the cause of the rare cases in which severe symptoms take place in healthy subjects, shock being the exciting cause.

Stimulants may be necessary and cupping of the loins. It might be that the normal salt solution would be useful in these cases.

## CHAPTER XIX.

### ENURESIS.

**Synonym.**—Incontinence of urine.

**Definition.**—Involuntary passage of urine, especially in children.

**Etiology.**—The causes are obscure. There is probably either a congenitally weak sphincter or an abnormally irritable detrusor.

In some cases the child is neurotic, of epileptic parents or ancestry, or it may occur as a symptom of organic nervous disease, as epilepsy. It may be the result of defective moral education, indolence, lack of conveniences for urinating, indigestible meals at night, the eating of too much fruit or the drinking of beer. Worms may cause it by reflex disturbance. In asylums it results from imitation.

Townsend's classification of the causes with some additions by the writer is as follows :

#### I. Reflex.

(1) Increased quantity of urine :

(a) diabetes, (b) nephritis.

(2) Irritant quality of urine :

(a) increased acidity, (b) uric acid crystals, (c) calcic oxalate crystals, (d) excess of phosphates.

(3) Vesical calculus.

(4) Hypersensitive state of external genitals from :

(a) small meatus or stricture of urethra, (b) phimosis, (c) balanitis or vulvitis, (d) adherent prepuce and clitoris.

(5) Anal irritation from :

(a) pin-worms, (b) fissures, (c) eczema, (d) vegetations.

(6) Psychical.

(7) Increased irritability of bladder.

II. Atony of sphincter vesicæ.

(1) General debility.

(2) Spinal disease.

(3) Acute febrile disease.

III. Malformations of bladder or urethra.

To I. 4 may be added, hypersensitive conditions of the external genitals due to inflammation of the vagina, vestibule, and urethra, caused by masturbation. Small polypous excrescences about the meatus urinarius in girls.

Among the above small ureters, a small bladder and hypospadias are organic causes. Central lesion of the brain and cord may also be the cause.

**Occurrence.**—The condition is pathological between the years of four and ten, or even more.

Nocturnal enuresis usually occurs in the first hours after the patient goes to sleep, but it may happen later, or even toward morning.

Incontinence of urine may be either nocturnal or diurnal. It may be noticed in old people and sometimes in advanced cases of diseases of the kidneys, or in diabetes.

The patient is usually a pallid, excitable child.

**Diagnosis.**—Inability to retain the urine, which passes involuntarily, either by night during sleep or in the daytime.

**Course.**—Some cases may yield to carefully conducted and systematic treatment. As a rule, the condition wears off when the patient arrives at puberty. The mental effect, however, on the child is depressing and effort should always be made to overcome the trouble. It usually subsides after the twelfth year of life.

**Effects.**—These are chiefly mental. The patient is likely to become worried and depressed. In some instances suicide has resulted.

**Examination of the Patient.**—I. Examine the rectum; look for pin-worms, fissure, eczema; constipation to be inquired into.

2. Examine the external genitals ; look for sensitive clitoris, tight prepuce, narrow meatus.

3. Watch the child for masturbation. Look for balanitis, vulvitis, stricture of the urethra, urethritis, sensitive urethra, excrescences about the meatus urinarius in girls. Vaginal catarrh must not be forgotten. Possibility of retention in the bladder should not be overlooked.

4. In case nothing can be found by examination as above collect the twenty-four hours' urine, examine it, and also a freshly-voided specimen ; the night urine may be saved either by the devices already mentioned in case of young children, or by use of a rubber urinal in older ones.

The points to be sought for in the examination of urine are presence of cystitis, pyelitis, nephritis, or diabetes ; or, if these are absent, effort should be made to ascertain whether or not there is increased acidity, whether uric acid crystals, calcic oxalate, triple phosphate, or even simple phosphates (earthy) are present.

5. If the condition of the urine shows nothing, look for malformations of the urethra and bladder, and for stone in the bladder.

6. Still further, if nothing thus far has been found as a cause, consider muscular weakness of the bladder due to general debility, anaemia ; inquire for history of recent severe illness, as typhoid. Investigate the possibility of spinal disease; and look carefully for slight palsies. Nocturnal epilepsy must not be forgotten, and mouth-breathing looked after.

7. Even if no signs of uricæmia be present in the urine, examine patient for presence of tonsilitis or pharyngeal irritation, and, if found, examine urine frequently for evidences of uricæmia, especially that voided after over-fatigue at play.

8. Next inquire for psychical causes ; ask the child if he dreams that he wants to urinate, or that he is urinating. Observe whether the child is intensely somnolent, unbal-

anced, etc., etc. Ascertain whether *periodicity* of incontinence is a marked feature; if so, the case is of nervous origin.

**Treatment.**—The cause must be ascertained, but in children the following is, as a rule, of help: Cool sponge-bath, with tablespoonful of sea salt added to the water, every morning. Body briskly rubbed, and especially in the region of the spine, with a moderately coarse towel. Child to be clad in woolens next to skin and to have warm shoes; it should have as much fresh air as possible in fine weather and be allowed to exercise. But very little meat should be allowed, and the quantity of drink should be restricted, in the latter part of the day especially, no fluid being given after 4 or 5 o'clock in the afternoon. The child should empty the bladder before going to sleep and should be taken up to urinate late at night and early in the morning; if necessary, once also during the night, in each case being thoroughly awakened.

The patient should not be too warmly covered while in bed nor should he lie on his back. If necessary, a brush can be tied to the back so that the patient may be roused when he turns over. If possible, he should lie with the hips elevated and the head low.

An admirable rule is that the bowels be thoroughly cleansed by an enema shortly before bed time.

The evening meal should be taken two hours before bed time. The child should avoid liquids, potatoes, and heavy indigestible foods.

The bed should be provided with a firm mattress. In awakening the child to urinate, it is a good plan to observe regular hours, namely, at 10, 12, and 3.

The child should be impressed with the idea that he must not wet the bed, but corporal punishment is not to be allowed.

Rubbing the body with cold water before bed-time is often of service.

*Electricity* is said to do good in some cases. It may be ap-

plied as follows: A broad anode is placed over the lumbar region of the spinal cord and a smaller cathode over the bladder or perineum; a quite strong constant current is allowed to pass for two or three minutes, after which pass the wire end of one conducting cord, which we can make the cathode, into the mouth of the urethra for one or two centimeters, while we place the other broad electrode on the perineum, or above the symphysis, and allow quite a strong or even somewhat painful faradic current act for a minute or two. This should be done once daily at first.

*Dilatation of the posterior urethra*, by means of large bougies, is sometimes a successful measure.

**Symptomatic Treatment.**—In this disorder the high potency men cure with Ignatia, Causticum, Pulsatilla or Sulphur in the thirtieth or upwards. Other remedies are as follows:

*Cina*.—The urine is turbid, abundant and contains an increased amount of urea. There is a feeling of constriction about the loins and a bruised feeling in the small of the back, not worse on motion. There may be restless sleep with rolling of the eyes and symptoms referable to presence of worms.

(Use tincture in one to five drop doses.)

Agaricus, Cimicifuga, Equisetum, Gelsemium, Hyoscyamus, Nux vomica, Pulsatilla, Rhus tox., Terebinth, Stramonium, Santonine and Triticum repens are also used.

*Cina* in the tincture, dose, five drops or even more, three or four times daily, may help the case when the usual indications for the remedy are present, as when the trouble is traceable to worms. Causticum, Sulphur, Aconite, Ignatia, Benzoic acid, Ferrum phos., Lycopodium, and Staphysagria are recommended by various writers.

**Palliative Treatment.**—The principal remedies are Rhus aromatica, Belladonna and Strychnine.

*Rhus aromatica* is given when the case would appear to be due to lack of tone in the sphincter due to general debility,

especially in nocturnal incontinence of urine in children. Dose, from 4 to 10 drops of the fluid extract four times daily, gradually increased to from 8 to 20 or 30, according to age of child. May be given in a little sweetened water. Or, children 2 to 6 years old may take 10 drops night and morning ; other children, 15 drops in the afternoon and again before bed-time.

In one of the writer's cases 30 drops of the fluid extract taken at one dose before bedtime would always prevent enuresis, but, if the remedy was omitted, the child wet the bed.

*Belladonna* is given when there is irritability of the bladder, in 10- to 20-drop doses of the tincture, or *Atropine sulphate*, one grain in an ounce of water, given in doses of one drop for each year of the child, at 4 and at 7, evenings, so as to have pupils dilated during hours of sleep. The dose at bedtime need not be given, if the child's pupils are well dilated. (Baruch.)

There are those who claim success from Belladonna and the Bromides in cases where Belladonna alone fails.

In the case of small, feeble children great care must be taken in giving Atropine.

Belladonna plasters over the region of the kidneys may be used ; one plaster may be cut in two and half placed over the region of each kidney and worn for several days.

*Strychnine* is given together with Belladonna when there is diurnal enuresis, three or four times daily.

Various other remedies are recommended, as follows :

*Rhus tox.* has long been used.

*Equisetum*, *Eupatorium purpureum*, *Pulsatilla* and *Gelsemium* are credited with cures.

*Liquor ferri muriatici* is recommended ; two drops in a wineglassful of water, tablespoonful every three hours during the day for anaemic children.

*Ergot* and *electricity* are used in cases of atony of the sphincter.

White uses the following for incontinence :

- B. Sodii benzoatis,  
Sodii salicylatis, . . . . . ää gr.xx.  
Fl. ext. belladonnæ, . . . . . gtt. ij.  
Aquæ cinnamomi, . . . . . 3iv.  
M. Sig. A teaspoonful four or five times daily.

*Hypnosis with suggestion* has relieved some cases.

According to Barbour a combination of Boric acid and Salol is by far the most efficient remedy.

*Surgical treatment* may be necessary to relieve tight prepuce, hooded clitoris, narrow meatus, etc.

The passage of cold steel sounds is said to be curative in some cases in young boys, especially in those who masturbate.

According to Lydston, of Chicago, the urethral sound is one of the most valuable measures for the treatment of a large proportion of cases of involuntary micturition in children. It acts in three ways: First, by blunting the sensibility of the nervous supply of the vesical neck, thus correcting hyperesthesia; secondly, by decongesting the mucous membrane of the deep urethra, i. e., the vesical neck; thirdly, in cases of a purely neurotic type, it stimulates the relaxed sphincter vesicæ to contract, and, so to speak, exercises it. The resentment which the muscle offers to the entrance of the sound produces a stimulation of nutrition of the muscle, increases its bulk, and adds to its tonicity, thus enabling it to resist with more success the egress of urine.

The removal of hyperplasias from the nose, of phimosis and villous growths from the urethra should be undertaken.

## CHAPTER XX.

### GLYCOSURIA AND DIABETES MELLITUS. DIABETES INSIPIDUS.

We use the term glycosuria or melituria to describe a more or less temporary condition, in which sugar appears in the urine under varied circumstances. If the amount of sugar is slight and it soon disappears, the condition may be merely glycosuria. It is noticed (1) in healthy persons after excessive indulgence in sugar; 200 gm. (seven ounces) or upwards at one time of grape sugar, in solution, may cause the appearance in an hour or two of a small amount of dextrose in the urine (alimentary glycosuria). If sugar appear in the urine after taking small amounts, as 50 to 100 gm. (two to three ounces) the condition is called morbid alimentary glycosuria. The writer has observed this condition occur in patients after taking certain articles of food or drink, notably, bananas and champagne. In such cases the power to assimilate sugar is subnormal and the condition may be followed in time by true diabetes mellitus. The writer has found that the best time for the detection of morbid alimentary glycosuria is in the afternoon, the saccharine articles being taken at lunch.

Such a glycosuria is observed according to Strümpel in obese beer drinkers, in patients with severe traumatic neurosis, and in exophthalmic goitre. Temporary glycosuria may occur in acute infectious diseases (typhoid, scarlet fever, diphtheria, malaria, cholera, malignant pustule,) in nervous disturbances as from injuries to the head, in diseases of the brain, and after epileptic fits, after the administration of drugs in toxic doses as Curare, Amyl nitrite, Mercury, Morphine, Hydrocyanic acid, in poisoning by Carbonic oxide, and after ingestion of Phloridzin, in the latter case without general disturbance, and after the injection of Supra-renal extract.

Inasmuch as the causes of temporary glycosuria mentioned above may also in some cases occasion a true chronic diabetes mellitus, care must be taken not to regard the condition as unimportant. In the writer's experience temporary glycosuria is a comparatively rare condition.

## DIABETES MELLITUS.

**Definition.**—A chronic disease characterized by persistent presence of dextrose in the urine, and in severe cases by polyuria, polydipsia, digestive disturbances, and progressive loss of flesh and strength.

**Etiology.**—The causes of diabetes mellitus are said to be as follows :

1. Heredity, as in members of the same family.
2. Syphilis or syphilitic parentage (rarely).
3. Gout or gouty ancestry and general arterio-sclerosis.
4. Nervous shocks and strains ; various nerve injuries and nervous diseases.
5. Acute infectious diseases (occasionally) and exposure to cold.
6. Diseases of the pancreas and liver.
7. Improper dietary ; long continued indulgence in sweets ; sedentary life and over-eating. Excessive beer-drinking, or drinking of cold fluids.
8. Emotional disturbances, as shock of bereavement, etc.
9. The causes of temporary glycosuria mentioned above.

Of the diseases of the pancreas, concrements in the ducts is the principal one ; of the liver, traumatism, congestion, and cirrhosis.

Diabetes mellitus in children has been known to follow typhoid fever and purpura haemorrhagica.

Stern saw one case in which the children were seemingly born with diabetes mellitus.

Drummond reports a case in a boy of seven who died of

diabetic coma five months after receiving a blow on the head.

Diabetes mellitus may be the chief symptom of cerebral syphilis or other lesion encroaching on the medulla.

Falls, blows, railway accidents and violent mechanical agitation of the nervous system are known to cause diabetes.

The disease may alternate in families with central neuroses (hysteria, neurasthenia and epilepsy) or mental disorders.

In cases of diabetes due to injury there is probably some peculiarity in the individual.

Obesity is a forerunner of diabetes in some cases, but the exact relation has not been determined.

In a few cases influenza appears to play some part as an exciting cause.

A case is reported due to lightning stroke.

It is possible that pregnancy, the puerperal state, or the condition of the breast may be exciting causes ; the climacteric may also, possibly, be an exciting cause.

Diabetes mellitus is occasionally closely related to insipidus.

Pathological anatomy alone does not furnish any clear evidence that diabetes is related to hepatic changes.

Emotional disturbances apparently play some part as exciting causes. It is quite possible that some slight functional change in the medulla may be the cause or play some important part in causation of certain cases.

In a considerable number of cases of diabetes where the pancreas has been studied post-mortem it seems probable that the diabetes was either due to some other cause than pancreatic lesion, or to some functional or vasomotor change in the pancreas.

In a smaller number it appears probable that the pancreatic disease was the cause of the diabetes.

It is conceivable that arterio-sclerosis may cause diabetes by producing changes in the pancreas or in the medulla.

In one hundred consecutive cases of diabetes Williamson found a history of alcoholic excess in 17 cases, no definite history in 15, heredity in 13, emotional disturbance in 10, anxiety and worry in 8, influenza in 8, sudden onset of thirst in 9, pregnancy, etc., in 7, external injury in 6, overwork in 5, syphilis in 6, obesity in 4, nasal catarrh and bronchitis in 3, pleurisy in 2, pneumonia in 1, acromegaly in 2.

Osler thinks that intense application to business, overindulgence in food and drink and a sedentary life are conducive to it.

In children it is usually due to hereditary influences or injuries, or develops during convalescence from severe acute infectious diseases.

In adults those who are obese, gouty, and subject to gallstones or renal calculi are more liable to it.

It is said that a family history of tuberculosis is frequently met with in diabetics. Considering, however, that family history of tuberculosis is, especially in New England and in other parts of the world, common to many who never have diabetes, the writer thinks it more likely a coincidence than an etiological factor.

Gastric catarrh is mentioned in connection with the etiology, but, since the connection of gastro-intestinal troubles with the prodromata of diabetes has been discovered, it is possible that this disorder is an early manifestation rather than a cause.

According to John A. Larrabee diabetes is connected with inherited neurotic tendencies. Epileptic, nervous, or hysterical parents are responsible, he thinks, for the diabetic diathesis in children.

Mild cases may become more severe under the influence of traumatism. It, therefore, becomes of interest to determine whether the advent of the disease is hastened by trauma in a patient presumably in the prodromal stage.

Loomis speaks of a female child, twelve years of age, who,

after fourteen months' illness from nephritis, coming on eighteen months after scarlet fever, suddenly died of diabetic coma.

*Transient glycosuria* in children has been noticed following a number of conditions ; malaria, measles, immoderate and also indiscriminate eating ; daily exposure to wet and cold.

The writer finds that in all his cases but one there was a history of fondness for sweets and indulgence in them.

According to Haas, of New York, there is a possible etiologic connection between peliosis rheumatica and diabetes. He reports two cases in children, aged five and nine years respectively :

The two cases occurred in children who were members of the same family. The father and grandfather and an aunt on the paternal side, as well as the maternal grandmother, had tuberculosis. No diabetes had occurred in any other member of the family. The first was a combination of peliosis rheumatica and diabetes, and exhibited the symptoms of the rheumatoid condition, the purpuric eruption, etc., together with glycosuria. The former disappeared after a week, and the girl was doing well at last report. The second case occurred in a boy who had sustained severe injuries eighteen months before, but unfortunately the exact nature of this injury could not be determined from anamnesis, otherwise a clue as to its etiologic significance might have been obtained.

According to Leese heredity is of some importance as a cause of diabetes, and is often limited to one line or side of the family ; but the disease does not seem to be conveyed from one person to another, even when living in the most intimate relations. Cases where both husband and wife are affected are due rather to both parties being subject to the same diet and living under like conditions, and having similar cares of life. Diabetes is more rare in women than in men. It is least frequent before puberty, increasing during the child-bearing period, and diminishes again in old age. Obesity from

high living and a sedentary life predispose to diabetes, which has been termed constitutional diabetes, and is more common in women, in contrast to neurogenous or accidental diabetes occurring after injuries or alterations of the nerves, which occurs more often in men.

**Occurrence.**—Adults between thirty and sixty are more subject than children, and men than women. Fat persons are more subject to it than lean, and it is a disorder of considerable frequency among Jews and Hindus.

The writer thinks diabetes mellitus in children to be fairly common in the West as compared with certain other localities. Out of a total of 226 cases of diabetes which the writer has seen, 26 were children, while Prout out of 700 saw only about a dozen in children, and Schmitz (presumably a German authority) out of 2115 cases in all saw only 85 under twenty years of age, while only 10 of these were under ten years of age.

Cases are common in the same family. The writer knows a family which has lost three children in succession of diabetes millitus. Isenflam reports a case in which eight children of healthy parents all died of diabetes mellitus after reaching their eighth year.

Female children are said to be more susceptible to diabetes mellitus than males.

Diabetes mellitus is rare in children under five years.

Locomotive engineers show seven times as great mortality from diabetes in America as others.

Diabetes is said to be common among Wall Street men.

It is common in certain countries and districts as in India, Ceylon, Italy, Malta, Normandy and the cities of France.

The disease is more rare in America than in Europe, the mortality here being 2.8 in 100,000 of the population, while in Europe it is from 5 to 9, but it is increasing in America apparently with the increase in extravagant or luxurious living. In the colder parts of the United States the higher

mortality is found in the rural districts, while in warmer parts it is higher in the cities. American Indians and Chinamen in the United States are free from it. It is uncommon in negroes. The disease is commoner among well-to-do people than among the poor by ten times.

Husband and wife may have the disease, but it is probably accidental in such cases, or due to similar conditions of life.

It is said that more cases develop in March, April, July and November than in other months.

Those of neurotic temperament are more subject to it than others.

**Pathology.**—An excess of sugar in the blood may result from the following causes :

1. Increased supply in the diet.
2. Failure on part of the body to decompose or store that which is introduced, due (*a*) to disturbances of the portal circulation, or (*b*) disturbances in the function of the liver. Faulty innervation may be the cause of the disturbances in the portal circulation, and the functional hepatic disturbances may bring it about that either more glucose enters the blood without being transformed into glycogen in the liver or an excessive transformation of glycogen in the liver takes place, setting free an excessive amount of sugar.

Pavy's idea of diabetes is that the whole trouble is due to imperfect de-arterialized venous blood, consequent upon vaso-motor paralysis, especially of the vessels of the chylo-poietic system.

Larrabee thinks there is changed polarity of the nervous system without observable lesion.

The opinion is gradually gaining ground that diabetes is not a pathological entity, but rather a group of symptoms which may be produced by various morbid changes in the system. Sometimes the starting point is in the nervous system, sometimes in the pancreas, occasionally in arteriosclerosis, possibly in the muscles sometimes and possibly it is

due to various other causes and to endogenous or inherited morbid conditions. (Williamson.)

According to Flexner, although the pancreas has been shown to influence and regulate carbo-hydrate metabolism, it is by no means proven that the cause of diabetes is always resident within that organ. The complete removal of the pancreas in animals is always followed by a diabetes of severe type, yet it can be removed in part, and not necessarily be followed by diabetic symptoms. The amount of the gland left behind should be at least one-fifth. It is also known that the diabetes resulting from the extirpation of the pancreas is fatal. Of the causes of the pathological changes in the pancreas, the chief one is supplied by concrements in the ducts.

That diabetes can result from disease of the liver seems probable, as that condition has been observed following traumatism, as an accompaniment of cirrhosis and congestion.

Pathological conditions of the central nervous system and the peripheral nerves may cause diabetes and glycosuria. What the relation of the central nervous system and the organs of the carbo-hydrate metabolism is we are not informed. Naunyn states: "I hold it as proven that diseases of the nervous system lead to diabetes, in that there occur coincidently disturbances of function in other organs which preside over the carbo-hydrate metabolism; that these disturbances are not simple expressions of the abnormal functional activity of the central organs; but, using the analogy of the motor in contra-distinction to the nutritive or secretory neuron, we can imagine that each stands for an entity, the one acting on the muscle cell (motor neuron) and the other upon secretory cells, as in the liver and pancreas (secretory or nutritive neuron). And just as diseases of the motor neuron in any part set up pathological changes in the entire system, so may the secretory organic cells be influenced injuriously in such ways as to give rise to diabetes, because of their con-

nection with diseased nervous structures with which they indissolubly unite, and under whose domination they are." The existence of the renal form of diabetes is yet unproven.

**Post-Mortem Appearances.**—The post-mortem appearances show the following :

1. In many cases no lesions at all.
2. In some cases lesions of pancreas and tissues in its vicinity.
3. Hypertrophy of the liver, in some cases no change.
4. Enlargement of the kidneys with injection and presence of glycogen in Henle's tubes near the bases of the pyramids, with also, at times, fatty degeneration of tubular epithelium.
5. Evidences of tuberculosis of the lungs and other changes in them.
6. In a case reported by Joseph B. Betts autopsy showed amongst other things *atrophy of the head of the pancreas*.

The pancreas showed moderate interacinar cirrhosis. The islands of Langerhans were normal in number, but many were not clearly defined, and some were surrounded by a distinct connective tissue capsule, which separated them into little lobules. In the bodies themselves were many cirrhotic islands, some of them apparently degenerating in their central portion. The head of the pancreas was loose in structure, and in some lobules the secreting acini were atrophied. The islands were scarce and were surrounded by thick fibrous capsules, and were separated into lobules by thick bands, evidently the thickened capillaries of the island. Bands of fibrous tissue extended outward between the acini. In sections from the head of the pancreas no islands could be found, and in some parts the cells seemed to be degenerating. Throughout the pancreas the larger vessels showed decided arteriosclerosis and venous congestion. The cirrhosis was of the interacinar type, and, as a rule, was most marked in the immediate vicinity of the islands of Langerhans, although in some sections it appeared to extend from the thickened walls of the ducts.

7. Frerichs has demonstrated by means of the microscope lesions of the medulla oblongata in frequent instances, but the changes enumerated by him are not always present and their significance is doubtful.

The condition of the kidneys and of the lungs above described is due to organic diseases which are merely complications, so that on the whole the pathological changes are trifling. Modern study is being directed more and more to the pancreas and to hyaline degeneration of the islands of Langerhans in it. According to Anders, the pancreas shows morbid changes in fifty per cent. of the cases.

**Onset.**—There are those who manifest a tendency to diabetes by various symptoms, especially by the occurrence of transient glycasuria usually in the afternoon. Stern claims that the prodromic stage of diabetes mellitus is characterized by the following:

1. Gastro-intestinal disturbances, intolerance of carbohydrates and occasionally of hydrocarbons, hyperchlorhydria, gastrocholia, hepatico-pancreatic disturbances.

2. Sickening pain in the epigastric region, increasing after eating and upon pressure; dull pain in right hypochondriac region; sometimes a feeling of tension around the umbilicus.

3. Polysarcia, the obesity disappearing as dextrose is eliminated; no excessive appetite or thirst.

4. Diminution of sexual inclination; great nervous irritability and occasional hypochondriasis when there are concomitant genito-urinary neuroses; no emaciation, if no diathesis is present in the individual other than the diabetic.

5. Disorders of the cutaneous surface; dermatalgia; diminution or suppression of perspiration and transpiration; overloading of the blood with carbon dioxide.

Stern holds that urine of the preglycosuric stage is quite normal, barring an occasional azoturia. In this the writer's experience does not coincide with that of Dr. Stern.

I have seen several cases which later became diabetic. In

not one of these cases could the urine, when first examined, be deemed normal in all respects. Two cases were apparently those of chronic interstitial nephritis, one was lithuria, several others had deposits of uric acid or calcium oxalate, with casts and a plain trace of albumin in the urine.

The writer's method of early recognition of the diabetic diathesis is to examine the urine of every micturition of the twenty-four hours separately. Sugar, recognizable by Haines' test-liquid, will be found at some one hour of the day—in the writer's experience most commonly after the digestion of the noonday meal, *i. e.*, about 3 o'clock in the afternoon. The symptoms that Stern speaks of may or may not be present, and sugar may occur with but few or none of Stern's symptoms except increase in weight, due to fat, which the writer believes is often significant.

In general, then, when a person who has become fat presents himself for examination the writer deems it wise to make separate tests of the urine of every urination of the twenty-four hours. Sugar will often be found in the urine voided two hours after the noonday meal. If it is not found, cause the patient to drink champagne, or eat cheap candy or 100 grammes of glucose, and test the urine the same day and next morning. If there is a glycosuric tendency, sugar will be found in the urine of one or more urinations.

Even if no sugar be found by these methods, but the patient, having become obese, voids urine containing albumin in small quantity and perhaps casts, or sediments of uric acid and urates or oxalate of lime, the case is a suspicious one. If, in addition to this, he also has a family history of diabetes mellitus and exhibits the succession of symptoms described by Stern, the case is, no doubt, in the prodromic stage of diabetic degeneration.

There are some persons who void an unusual amount (above 500 grains) of urea and of uric acid (above 10 grains) before the appearance of sugar. But while this is always sus-

picious (since fat people do not by any means normally void solids in proportion to their weight), it is not invariable. (It is quite common, however, in cases in which sugar has disappeared from the urine and albumin taken its place, the patient becoming nephritic; hence the physician is often puzzled to account for the condition of the urine as regards solids in what is evidently a case of chronic Bright's disease. The writer will illustrate by means of analyses of urine farther on.)

A peculiarity which the writer has noticed in two of the preglycosuric cases was that the small amount of albumin present was not reduced in the slightest degree by avoidance of meat, but remained in about the same bulk, regardless of diet.

The writer believes that a slight albuminuria and cylindruria in stout persons is possibly due to arterio-sclerosis, a forerunner of diabetes mellitus, which is, perhaps, not unfrequently hastened in its development by non-nitrogenous diet, which does not at the same time exclude sweets.

When diabetes mellitus itself appears there may be at first merely languor, loss of flesh, weakness and lack of endurance; or slight nervous disturbances, including headache, mental depression, wakefulness and neuralgia; in other cases gastro-intestinal symptoms, including nausea, eructations and irregularity of the bowels. Soon, however, the changes in the urine appear and a train of symptoms.

In some cases cramps in the calves of the legs or *sudden* thirst is the first symptom.

**Diagnosis.**—Thirst, polyuria, and the voiding of pale urine of specific gravity above 1024, containing sugar, establishes the diagnosis.

To distinguish glucose in the urine from glycuronic acid and lactose, Williamson advises fermenting the urine in a test-tube for twenty-four hours and then applying the copper test, as Fehling's. Glycuronic acid and lactose do not ferment

with yeast, hence if a slight reaction with the copper test was obtained before fermenting the same will be present after. Whereas if the slight reaction before fermenting was due to glucose, there will be none obtained after fermentation.

The writer uses Haines' test for sugar and has as yet not seen a reaction with it which was referable to glycuronic acid, though in one or two cases a reaction has been obtained due to lactose. The orcin test for glycuronic acid should also be tried.

Eichhorst says "the single trustworthy symptom is the presence of sugar in the urine" which, if found, requires explanation as regards cause, etc., whether the case is merely one of symptomatic glycosuria or true diabetes mellitus.

*Suspicious symptoms* are languor and debility, furunculosis, pruritus vulvæ in women, balanitis in men, cataract, sciatica, especially if bilateral, and impotence. In cases of temporary glycosuria, great care should be taken to assure the patient that diabetes mellitus is absent. In the writer's experience patients with temporary glycosuria are exceedingly nervous and inclined to worry about themselves. On the other hand it is often difficult to rouse the confirmed diabetic to a sense of the necessity of taking care of himself, which he will as a rule only do when he is alarmed.

In doubtful cases administer 100 gm. of grape sugar and test the urine a few hours after ingestion of it.

Williamson's blood test is an important element in the diagnosis of doubtful cases. (See *The Blood*, further on).

**Clinical Features.—*Polyuria*.**—There are, however, some few cases, usually mild ones, in which the quantity of urine is normal or sub-normal (*Diabetes Decipiens*). Severe cases may grow milder, and the urine become normal in quantity. In severe cases several gallons may be voided during the twenty-four hours. Drenching sweats may alternate with polyuria.

**Thirst.**—Usually in proportion to the percentage of sugar

or quantity of urine. May be so severe that the patient is unable to be away from the vicinity of drinking-water either by day or by night.

In some cases thirst is not at all a marked feature, though more or less dryness of the mouth is usually noticed by the patient.

In the case of children thirst is usually a marked feature. Eichhorst mentions cases where children have drunk their own urine when unable to obtain water.

*Hunger and Emaciation.*—More marked in lean patients. and unrelieved even by large quantities of food.

In mild cases the patient may merely testify to a "good appetite" and the loss of flesh be temporary and recovered from under treatment.

Osler mentions a case of the severe form in which hunger was so extreme in a man that he was paid to stay away from hotels where table d' hôte dinners were served.

*Sugar in the Urine.*—See remarks on the URINE.

*Other Constitutional Symptoms.*—In mild cases we find merely slight weakness on exertion. In severe cases great weakness, mental irritability and depression, and indisposition to mental effort. The bodily temperature is normal or slightly subnormal.

*Gastro-Intestinal Symptoms.*—Thirst and hunger have already been mentioned.

The tongue and mouth are dry. The former is broad, thick, sometimes of an irregular fissured surface and either coated or red.

Spongy, easily bleeding gums, and loose, carious teeth are noticed. White patches may be seen on the gums and soft palate.

The writer has observed in many cases that diabetics in talking manifest a peculiar "click," due to the condition of the tongue and the dry mouth. The saliva is acid and in severe cases thrush may form on the soft palate.

Constipation is very common in the cases when the red reaction with ferric chlorid is found. When relieved, it may cause disappearance of the reaction.

The symptoms of diabetes may be referred by a patient ignorant of the presence of the disease to the alimentary tract; there may be in severe cases gastric crises much like those of tabes, paroxysmal pains mistaken for gastralgia, constipation and even loss of appetite.

Obstinate constipation frequently precedes coma.

Gastric symptoms are absent until the last stage, or when the red reaction appears with ferric chlorid. Rigid diet may sometimes cause gastric catarrh.

*Constipation is very common.*

Diarrhoea may be severe, but at times only in earlier stages. It is a serious symptom.

The liver may be somewhat enlarged. Jaundice is common, but usually due to some complication.

Gastric crises (nausea, vomiting, fever, pain in the stomach and intestines, followed by great weakness) occur at times, usually, however, in the last stage, that of ethyl-diacetic acid poisoning. They are an unfavorable sign.

Gastric ulcer rarely occurs.

Dilatation of the stomach may occur, especially when the patient eats enormously.

*Liver and Pancreas.*—Noteworthy enlargement of the liver is rarely detected during life.

Gall stones may occur in obese patients.

Cases of so-called pancreatic diabetes present the following in exceedingly rare cases:

1. Tumor of the pancreas.
2. History of severe colic.
3. Maltose in the urine.
4. Fatty motions without jaundice.
5. Great quantity of nitrogenous material in the faeces.

*Respiratory Tract.*—Symptoms are absent in the milder

cases. In severe cases, especially in young patients, fruity odor of the breath, tuberculosis, pulmonary gangrene and croupous pneumonia occur.

Tubercular phthisis is by far the most common lung disease.

Chronic pneumonia (chronic pneumonic, non-tubercular phthisis) rarely occurs, as also acute croupous pneumonia. The latter, however, runs an acute course and is very fatal.

Emphysema and chronic bronchitis occasionally occur.

In diabetic pulmonary gangrene offensive expectoration may not be observed.

*Appearance of the Patient.*—The face may appear sunken and wasted, the wrinkles of the face about the mouth are well-marked, the naso-labial fold is deep or sharply defined and is frequently prolonged downward. There is rarely anaemia or pallor. There may be a slight degree of congestion or cyanosis about the tip of the nose, cheeks, or lips and sometimes the conjunctivæ appear abnormally moist. Patients are likely to look older than their years and to wear an expression of nervousness, anxiety, or grief. In mild cases there is no typical facial expression. The breath of the patient often has a fruity odor and acetone may be detected in it when coma is present.

*Circulatory Symptoms.*—The pulse is usually soft, except where general arterio-sclerosis is associated. In elderly patients and sometimes in young ones we may notice cardiac weakness and a slow pulse (50 or lower) on the one hand or a rapid one (100 to 120) on the other, with shortness of breath, faintness, etc.

The patient occasionally may die suddenly from heart failure.

In some cases Williamson has found the pulse remarkably hard and the tension very high, when there is no renal disease and the patient under middle age.

Arterio-sclerosis is often a complication. In many cases if

three fingers are placed on the radial artery and firm pressure made with the finger nearest the elbow so that the pulsation is arrested, the artery can be rolled beneath the two fingers as a hard cord.

*Genito-Urinary Symptoms.*—In women pruritus vulvæ is common, due to the irritation from decomposing saccharine urine. Eczema or furunculosis of the genitals may occur. In men balanitis, phimosis, and paraphimosis occur. Impotence is common in men. Chronic nephritis frequently occurs as a complication. In such cases sugar generally diminishes in the urine and may even be absent.

Pneumaturia is occasionally met with, due probably to formation of carbon dioxide from fermentation of the sugar in the bladder.

The trace of albumin in the urine may result from admixture with a little pus in cases of balanitis.

The pathological changes in the kidneys in 92 cases of diabetes examined post-mortem at Vienna by Kundrat showed parenchymatous and fatty degeneration in 24, granular kidney in 9, hypertrophy in 4, chronic tuberculosis in 2, acute haemorrhagic nephritis in 1.

Chronic interstitial nephritis is rare. It occurs almost exclusively in obese or gouty patients.

*Cutaneous Troubles.*—The skin lesions of diabetes are very numerous: asteatosis, anidrosis, paræsthesia xanthoma, gangrene, papular urticaria, eczema, erythema, psoriasis, acne, dermatitis, herpes zoster, mal perforant, purpura, bronzed skin, bullous and pemphigoid lesions, defluvium capillorum, paronychia, pruritus, eczema vulvæ, balanitis and balanoposthitis and furunculosis may occur. The patient may suffer from boils, carbuncles and gangrene of one or more toes which may take the form of perforating ulcer, or the latter occur independently on the feet. Erysipelas may also occur. If the heart is weak there may be œdema of the cellular tissue.

Boils generally occur in stout patients and may be single or

multiple. They usually develop upon the neck, back of the shoulders, or on the buttocks. In women they sometimes form on the labia of the vulva.

As a rule they occur mostly on the neck, occasionally on the face or other parts. They have a tendency to extend and become gangrenous, and are often a cause of death.

Gangrene affects the lower limbs, commencing in the toes. The patient develops severe symptoms, becomes drowsy and coma may occur. Wounds in diabetic patients heal badly and operation incision wounds also, as for example that for phimosis. But the operation for cataract is now very often successful.

*Bulbous fingers* have been noticed by Williamson. Spontaneous shedding of the nails has been noticed in a few cases.

*Anasarca* without obvious cause may occur, chiefly in the legs, occasionally in the hands, face and elsewhere.

*The Eye in Diabetes Mellitus.*—Retinitis and muscular paresis are among the ocular troubles noted. All the ocular tissues, viz., the cornea, iris, crystalline lens, vitreous humor, retina and muscles may be affected, but changes in the crystalline lens are the most common. In some cases, especially in children, cataract may develop with amazing rapidity, even in a few hours.

In young diabetics sudden blindness sometimes occurs.

Besides cataract we find pure accommodation paralysis in middle age, myopia in later life, vitreous opacities, retinitis, amblyopia, like tobacco amblyopia. The last two are very rare. The writer has, however, seen several cases of diabetic retinitis.

Cataract is usually bilateral and does not, as a rule, disappear under diabetic treatment, though it may improve for a time. A case of spontaneous disappearance has been reported.

Operation is usually successful, but occasionally has been followed by coma.

Retinitis, when occurring, is almost invariably in persons above forty-five years of age.

According to Williamson diabetic retinitis differs from albuminuric retinitis in that there is no diffuse retinitis and the retinal arteries and veins are not much changed in appearance. The haemorrhages, as a rule, are punctiform, it is not associated with optic neuritis, and the patches are distributed irregularly over the central part of the retina.

Very rarely albuminuric retinitis may occur in a diabetic who has contracted kidney.

Very rarely a tumor of the brain gives rise to optic neuritis and glycosuria in the same patient. (Williamson.)

Diabetic amblyopia resembles tobacco amblyopia. It is thought to be a retro-bulbar neuritis.

*The Ears.*—An acute inflammation of the middle ear of rapid onset occurs. Abundant suppuration, with tendency to severe haemorrhage and early extension to the mastoid is noticed in diabetes, but is not common.

*The Sexual Functions.*—Sexual desire and power are lessened in men and in severe cases in women. In elderly women with a mild form of diabetes it is said to be increased.

In some cases impotence is the first symptom noticed by men. It may disappear on treatment. The writer has had several cases who regained sexual power on dietetic treatment alone.

The menstrual functions may be more or less deranged. Amenorrhœa is sometimes an early symptom. In pregnant women there is a marked tendency to abortion.

Death of the foetus occurs in fifty per cent. of the cases. The disease becomes worse in the mother after confinement.

*The Nervous System*—Mental depression is very common. Headache, mental and physical hebetude, loss of memory, sleeplessness, weakness of judgment and will, localized muscular paresis, cramps in the calves, absence of patellar reflexes, neuralgia, sciatica, which may be bilateral and ob-

stinate, localized cutaneous anaesthesia and coma are noticed.

Mental excitement is known to aggravate glycosuria.

Not infrequently the diabetic patient becomes cunning and deceitful in regard to minor matters. As Dickinson says, the mind deteriorates morally and intellectually.

The writer knows of one case, that of an adult woman, who, being diabetic, died insane.

Epilepsy and diabetes sometimes occur simultaneously.

In a few rare cases symptoms resembling those of general paralysis have been met with in diabetic patients and have improved on diabetic diet.

Occasionally, though very rarely, spinal cord disease may be the cause of diabetes, and in some cases the two seem to be associated. Changes in the spinal cord, the result of diabetes and due to some toxic agent in the blood, have been observed by Williamson.

As a rule, the loss of patellar reflex is more frequently associated with unfavorable symptoms in the patient in severe cases. Loss of the wrist-jerk is frequently observed in severe cases. Slight symptoms of neuritis, such as pain in the legs, cramps, numbness, tingling, tenderness and absence of knee-jerks are not infrequent in diabetes, but marked paresis or paralysis is rare. (Williamson.)

Eichhorst mentions cases in which peripheral pseudo-tabes occurs, with ataxic gait, swaying of the body when the eyes are closed and slow pupillary reaction.

*Miscellaneous.*—Stark calls attention to the following signs and symptoms of diabetes mellitus frequently encountered in middle-aged women :

Periodic attacks of headache in obese subjects over thirty-five years of age ; extreme and lasting fatigue after short but violent exercise, and prolonged fatigue, say, of one or two days' duration, following slight exercise ; slowly failing vision in the aged or quickly failing vision in the young ; certain signs referable to the mouth, such as acid saliva, receding gums, fissured and extremely reddened tongue.

Two varieties of symptoms are referable to the heart and its functions—the one set simulating an attack of angina pectoris and a second set presenting the physical signs of arteriosclerosis, or of cardiac hypertrophy. This latter set of cases may be met with not infrequently in obese male subjects with florid countenances and with otherwise healthy appearances. Another train of symptoms is referable to the nervous system.

In young patients the lungs and sputa must be examined for evidences of phthisis and in elderly ones the heart must be watched for signs of dilatation or other disease.

In sucking babes loss of flesh is sometimes the first noticeable symptom of diabetes.

Diabetes sometimes manifests itself in children by bed-wetting.

**The Urine.**—1. Polyuria is an important feature. As much as 19,200 c. c. (640 fl.oz.) has been noticed, but usually the quantity varies from 3000 c. c. to 9000 at most. In mild cases there may be no polyuria or even a diminished amount of urine (*diabetes decipiens*). The amount of sugar does not always run parallel to the amount of urine.

The amount of urine is about equal to the amount of fluid taken.

The features are the following :

2. *Persistent presence of dextrose*; in well-marked cases the average is four per cent. The writer has seen no higher than seven and a half, but ten per cent. or more has been reported. The largest known amount in twenty-four hours is two and one-fifth pounds (one kilogram).

3. *High specific gravity* (due to sugar, and sometimes to excess of urea as well), even above 1050. Low specific gravity does not exclude the disease. The writer has seen one or two cases in which the specific gravity for a time was below 1013. Strümpell has seen it as low as 1007.

4. *Light lemon-yellow color*, when fresh. The greenish tint is peculiar.

5. *Increased frothiness.* Acid reaction.
  6. Urine drying on black shoes leaves white specks and stiffens the linen.
  7. In severe cases increase of urea and phosphoric acid; in a number of mild cases, however, the writer finds these substances normal or even sub-normal in amount.
  8. Traces of albumin. In the writer's experience several cases of diabetes have begun with a persistent albuminuria, the albumin not exceeding ten per cent. bulk and disappearing to a trace when glycosuria and polyuria appeared.
  9. Peculiar fruity odor; noticed usually in later stages.
  10. Occasional or periodic appearance of fat.
  11. *Calcium oxalate crystals* in sediment frequently occur. Also *uric acid crystals* sometimes in great abundance.
  12. *Spores of fungi* present in all cases as soon as the urine in fermenting grows more acid. A cloud may be seen at the top of the glass.
  13. In later stages acetone, ethyl-diacetic acid, and  $\beta$ -oxybutyric acid, due to the disturbed oxidation of albuminous substances in the food and in the body. Formic acid is also present.
  14. In later stages, and especially before the attacks due to presence of ethyl-diacetic acid, the *acidity* of the urine increases and the sugar may decrease or even be absent.
  15. The amount of ammonia in the urine may be largely increased; as much as forty-five to ninety grains may be present in twenty-four hours.
  16. Oxybutyric acid may be present in large amount, as much as two or three ounces (50 to 100 gm.) in twenty-four hours. It is due to the destruction of body-albumin.
- The sugar in the urine is diminished by muscular exercise in well-nourished persons, but increased in those who are wasted; by worry or emotional disturbance or fatigue. It is diminished by febrile intercurrent affections, by phthisis, ascites, gout, jaundice, contracting kidney, pneumonia and diabetic coma, and may be absent under these conditions.

Albumin in the urine if only a trace is of no significance, but if in appreciable amount with casts signifies nephritis.

Tube-casts are not found in the urine unless there is complicating nephritis until coma comes on, when a large number of grayish granular casts appear.

The writer deems the advent of these casts in connection with the ferric chlorid reaction and coma an infallible sign of approaching death.

It is well to remember that hysterical women sometimes put sugar in their urine for purposes of deception. If cane-sugar is used but a slight reaction will be obtained with the ordinary copper tests, but if glucose or lactose are used the reaction will be marked. In suspected cases the specific gravity of the urine will doubtless be exceedingly high, unless the patient knows enough to add just the right amount. A specific gravity above 1060 should arouse suspicion.

**The Blood in Diabetes.**—Diabetes mellitus is not necessarily associated with any diminution of the number of red corpuscles. Leucocytosis accompanying digestion is frequently well marked in severe cases.

The percentage of fat is sometimes greatly increased.

The amount of sugar may reach as high as 0.48 per cent. instead of 0.04 to 0.1 per cent.

Williamson distinguishes the blood of a diabetic from that of a healthy person by the decolorization of a warm alkaline 1 in 6,000 solution of methylene blue, from blue to yellow-green or yellow.

Diabetic blood gives reaction with various aniline stains, as Congo-red, Biebrich scarlet and Ehrlich-Biondis staining fluid.

**Clinical Classification.**—An attempt has been made to classify diabetes mellitus according to its pathology, into dietetic, neurotic, and pancreatic cases. This classification is, however, difficult to demonstrate clinically. The best classification is that which has long been made into mild and

severe cases, according to the influence of diet and the presence of the ferric chlorid reaction in the urine. The writer sub-divides the mild cases into those more manageable and those less manageable.

[Rare cases may occur in which features of pancreatic disease may be present with defective assimilation of albumin and fats, absence of marked thirst or polyuria, presence of fat in the stools, etc. These cases pursue a severe and rapid course. The patients complain of epigastric pain and there may be signs of a pancreatic growth.]

In the milder cases exclusion of carbohydrates from the diet is followed by the disappearance of sugar from the urine in from one to three days ; in the less mild cases it may require fourteen days ; in serious cases it may never wholly disappear.

Williamson distinguishes two chief forms—*the severe*, in which thirst, hunger and diuresis are well marked, in which sugar does not disappear on rigid diet, and in which the disease runs a rapid course, one to three years, with death from coma or phthisis, or in children even in a few weeks, and the *mild form*, in which thirst and diuresis are not well marked and in which sugar disappears from the urine on withdrawing carbohydrate from the food. The mild form occurs in old or middle-aged and frequently stout persons.

The writer finds that the mild cases may be clinically divided into more manageable and less manageable cases for reasons difficult to understand, though in some cases addiction to sweets undoubtedly explains it. There are a few apparently mild cases in which thirst and diuresis are not marked, but in which it is difficult to remove sugar from the urine by strict diet and in which the patient feels worse when the sugar is small in amount.

*Intermittent diabetes* occurs in which the symptoms disappear entirely from time to time, but recur after some shock, accident or indiscretion, and finally the disease may terminate fatally.

*Diabetes with pigmented skin* is known to occur. It is apparently a pathological and clinical entity. The melanoderma is most marked on the face, limbs and genitals, the onset is frequently sudden and the course rapid.

*Phosphatic diabetes* has been described by Ralfe. It resembles diabetes insipidus and the urine contains a great quantity of lime phosphate. In some instances sugar is present and in others it has subsequently appeared.

**Effects and Complications.**—The most common are as follows :

Chronic pulmonary tuberculosis, acute pneumonia, asthma, gangrene.

In later stages nephritis with albuminuria, cylindruria, and dropsy.

Cystitis (less common).

**Diabetes and Pregnancy.**—According to Lesse :

1. A woman suffering from diabetes is liable to serious danger if she marries.

2. The urine of every parturient woman should be examined for sugar when possible.

3. The prognosis of diabetes before the beginning of pregnancy is better than when it develops during pregnancy.

4. Most of the cases of diabetes developing primarily during pregnancy commence in the last half.

5. The induction of premature labor is only advisable in hydramnion and contracted pelvis.

6. The urine should be examined for sugar before any operation.

7. Operations on diabetic patients should not be performed unless delay in operating means a greater danger to the patient than the diabetes.

**Prognosis.**—In children the prognosis is bad. The writer, out of twenty-six cases coming under his observation, does not know positively of a single recovery, though several have been lost sight of. Ten are known to have died in periods

varying from a few months to a few years. One is in fairly good condition after two years of the disease.

Seventy-five per cent. of the cases in children observed by Stern, 117 in number, died.

In children, as a rule, the smaller the child the quicker the course of the disease, though exceptions occur; for example, a child born with diabetes mellitus has been known to recover in eighteen months.

Out of thirty-four cases in children, reported by Stern, one died in two days, and another was alive at the end of five years; seven were cured in less than a year, one recovering in a month; six died in one month; ten lived more than a year, to die finally.

In fifteen cases in children which the writer has collected, in addition to the twenty-six of his own, death took place in all in from six days to eighteen months from the time the diagnosis was made, or from the time of coming under observation.

One case, however, a boy of twelve, greatly improved under treatment, to be described further on, and is still alive (July, 1903) and in fair condition at the end of two years; but sugar in small quantity is still present in his urine.

In *adults* the prognosis is better as to time, though the disease, when once established (polyuria, glycosuria, loss of flesh, etc.), is essentially incurable. The *milder* cases live for years, perhaps as long as twenty years, certainly often ten years or more. The *severe* cases may not live more than a year, the usual duration being one to three years in those cases unaffected by diet or treatment.

The prognosis is rendered uncertain by the fact that mild cases may become suddenly severe, and severe cases improve up to a certain point and then linger in *statu quo* for several years. Fat diabetics usually suffer less and live longer than lean.

The writer has seen two cases in young women between

twenty and twenty-five. Both died in a year or two from the time the disease was sufficiently severe to manifest the usual symptoms, although all possible care and the best medical attention were given them.

Another young woman of twenty-nine lived to be thirty-three.

In general, the prognosis is ultimately unfavorable, though complete recovery doubtless occurs in the milder cases. One should always be skeptical about the permanence of an apparent recovery. Permanent recovery from a *severe* case probably never happens. In mild forms occurring in women about the climacteric recovery sometimes takes place.

The symptoms of diabetes may disappear when it is associated with pulmonary tuberculosis or nephritis, but death will ensue from the complication.

The writer finds in the case of adults that those who void over sixty grammes (930 grains) of urea in twenty-four hours seldom live more than a year or two at most.

**Unfavorable Signs.**—Sugar is not controlled perceptibly by diet and medication; extreme weakness; lower extremities oedematous; tongue red, raw and glazed; mouth and throat covered with aphthous patches; uncontrollable diarrhoea; acute inflammatory affection of the lungs, or, earlier in disease, chronic pneumonia. Sudden death from diabetic coma possible in such cases, especially when the red reaction with ferric chlorid is present in the urine.

The gradual disappearance of sugar, with the appearance of albumin and casts, is always a grave prognostic sign indicating chronic nephritis.

In general the prognosis is unfavorable when the most rigid exclusion of the carbohydrates from the diet fails to remove sugar from the urine. A practical difficulty in the way of utilizing this prognostic indication in private practice is frequently the addiction of adults to sweets, together with more or less self-indulgence and petty deceit, making it impossible

to be sure in some cases whether a rigid exclusion of carbohydrates is practiced or not.

Marked emaciation and loss of strength early in the disease is a bad sign.

Gangrene is an unfavorable indication.

Family history of severe diabetes is an unfavorable sign of importance.

Cases occurring in poor people are usually severe, and neither recognized nor attended to until too late.

The most unfavorable signs of all, and those indicating rapidly approaching death, are the fruity odor of the breath and urine, together with the red reaction with ferric chlorid in the urine, the presence of grayish granular casts in the sediment and the onset of drowsiness.

The presence of signs indicating a pancreatic case is a bad one, and the prognosis is then extremely unfavorable.

*Favorable signs* are, according to Williamson :

1. Ready disappearance of sugar by observance of dietary.
2. Old age.
3. Obesity, gout or uric acid diathesis.
4. Long duration of the disease without complication or much loss of weight or emaciation.
5. History of a mild form in other members of the family.
6. Favorable conditions of life.
7. Climacteric in women.
8. Transition into insipidus.

The writer has, however, seen a case in which sugar disappeared from the urine with remarkable rapidity under proper dietary, but the patient died comatose in a year's time in spite of favorable surroundings.

On the whole, the most favorable cases are those in which the glycosuria is transitory or intermittent, in stout overfeeders, or in cases due to mental strain.

The prognosis in the case of patients under forty is in the main unfavorable.

**Course.**—In children the disease runs a rapid course, from a few days, weeks or months to one or two years. Occasionally a child may survive five years.

In the case of young adults the writer's experience is that at most from three to five years is all that can be hoped for, and more commonly three, or less, than five. In adults the disease may last many years. Many patients live ten years.

In one of the writer's cases it certainly lasted twenty-three years, beginning when the patient was fifty and ending with coma at the age of seventy-three. Old people are subject to intermittent diabetes; sugar disappears and the patient is apparently well. Sooner or later, however, it recurs following emotional excitement or grave error in diet.

Diabetes in neurasthenics is likely to pursue a mild course.

The form associated with general arterio-sclerosis is usually easy to manage so far as the glycosuria is concerned.

Occasionally diabetes mellitus gradually changes into insipidus.

**Termination.**—In the majority of cases this is due to coma, exhaustion or marasmus; pulmonary consumption carries off a number of young persons; nephritis, furunculosis, carbuncles and gangrene are a common cause of death in diabetic cases.

Cerebral haemorrhage or softening is noticed as a termination.

Quite frequently the termination is by acute pneumonia, tubercular broncho-pneumonia or gangrene.

#### TREATMENT OF DIABETES MELLITUS.

When the disease is established, treatment is hygienic, dietetic and remedial. The essentials are as follows:

1. Fresh air with carefully regulated exercise. The importance of this measure must not be overlooked.
2. Diet suited to the individual, including use of hot alkaline mineral water.

3. Regulation of the bowels and functions of the skin.
4. Internal medication according to symptoms.

**Rest and Exercise.**—After every meal rest from half an hour to an hour. For exercise, light work in a garden, billiard playing, use of light dumb-bells, moderate rowing, splitting wood, moderate walking, especially up hill, and horseback-riding ; in hot weather driving. All exercise should be gentle, and, in the beginning, even *cautious*. Passive exercise may be used at first.

Carefully regulated mountain-climbing may be beneficial. (The writer took a diabetic once on a mountain-climbing expedition in the Adirondacks with the utmost benefit ; but great care was taken not to allow the patient to become exhausted from hunger. It happened on one occasion the patient gave up and declared his inability to reach the nearest hotel, but after eating a piece of cold beef-steak felt as strong as ever and continued the journey !)

The altitude should not be too high, and on that account the Adirondacks are better suited than the Western mountainous regions.

Williamson says :

“ The patient should be relieved of mental anxiety and worry as much as possible, and the hours of work, business or study should be diminished ; a holiday with complete rest from work often has an excellent effect on such patients. While in the mild form open-air exercise may be of service, in the more severe forms vigorous exercise is injurious and the fatigue induced by long railway journeys may be dangerous. It is well known that marriage has a most injurious effect on diabetic patients.”

**The Mental Condition.**—The patient should be relieved from anxieties and worry so far as possible. Change of scene is frequently of much service. Cheerful surroundings, music and entertainments are serviceable, but care should be taken that the diabetic is neither cooped up in a close atmosphere on the one hand nor chilled on the other.

Such patients as show a tendency to watch the sugar excretion closely should be prevented if possible from knowing the exact condition, and should be encouraged in every way. But the writer's experience with inveterate cases is that the patient somewhat resembles a man who is freezing, *i. e.*, is likely to lull himself to indifference from a sense of fancied security. The argument made often to the writer is that as they suffer no pain and have a "good appetite" there is no need of taking dietetic or other precautions. The writer thinks that much harm has been done by patting chronic cases on the back and assuring them that they are "all right." On the contrary, it will be found a difficult task to alarm them sufficiently to make them take proper care of themselves. Much judgment must therefore be exercised in influencing the mental condition of diabetics. The fact that occasionally a diabetic, who was in no danger at all at the time, has been literally "scared to death" is no argument that all diabetics should be allowed to think that they are in no danger. *The average diabetic of 3 years' standing will never kill himself with worry over his condition.* The more the worry, the milder the case. But be very careful not to alarm a patient who is in early stages of the disease. The writer knows of one patient, a physician, who died from the shock of discovering sugar in his own urine.

**The Sexual Function** should be carefully regulated. Marriage is bad for women and sexual excess for men.

**Warm clothing**, warm baths followed by friction, and massage are useful.

Massage is particularly useful for patients who are unable to take much exercise. Massage should be both general and over the abdominal viscera. *The regular Swedish gymnastics* are useful also.

Massage, not too vigorous, may be employed daily between breakfast and dinner. Schnée advises a weak solution of mercuric chloride in alcohol with a little vaseline to be used

in rubbing. In some cases, muscular tone is influenced by applications of electricity.

Static electricity is now much in vogue for the treatment of diabetes. Waterhouse reports favorable results from use of the galvanic current by the production of better nutrition and relief of nervous complications, but is not able to say that its effect is curative.

Williamson says electricity is useless in the treatment of diabetes mellitus.

**Residence.**—Sleeping-rooms should be well-aired and ventilated. Houses on high grounds to be selected. *Hot, stuffy rooms* to be avoided. Open fire-places a desideratum. Temperature of dwelling-rooms never below 60° nor above 72° F. Patient should, if possible, sleep in a room adjoining another in which the window is open, the door between being open. The air in dwelling-rooms should not be too dry in winter. Water should be evaporated in the room. In the winter, if the patient go abroad, he should seek the Riviera; in the summer, Carlsbad. The sea-shore is better than high altitudes. *In travelling, caution should be taken about fatiguing journeys.* Frequent stops should be made and rests taken.

**Climatology.**—The writer thinks that the benefit obtained by diabetics in the Gulf States or California is due more to open-air life than to special climatic influences. In general, the best climate is where the patient can be out-doors most. The mortality from diabetes has been found by Pardy to be highest in parts of the United States where there is the lowest range of temperature in conjunction with a high altitude.

**Baths.**—I have found the Turkish bath useful, especially for fat diabetics. Schnée advises first a Turkish bath, followed by a short stay in a Russian vapor-bath at a temperature not above 100° F., after which the skin is cooled off by a luke-warm shower. The patient is finally allowed to have a secondary perspiration on a couch and to rest for upwards of an hour. After twelve baths of this kind he claims that the

thirst begins to cease. The patient should drink a cup of beef tea an hour before entering the bath. At home, sponge bathing daily with lukewarm water, quickly followed by rubbing.

**Mineral Springs.**—Those most visited are Carlsbad, Vichy, Contrexéville, and Neuenahr. The writer thinks that one reason why Carlsbad does diabetics so much good is because the water there is taken hot. Alkaline waters, however, are known to benefit diabetics.

**Management of the Case.**—It is the writer's habit when consulted by a diabetic to proceed as follows:

1. The twenty-four hours' urine is collected and examined, not only for albumin and sugar, but for urea, phosphoric acid and uric acid. The ferric chlorid test is made. The sediment is examined with the microscope.

2. The patient's weight is noted and the condition of his heart and arteries observed.

3. His clinical history and symptoms are recorded and his general condition observed. The condition of the bowels is to be ascertained.

When the ratio of urea to uric acid is low, less than 40 to 1, and especially when there is a copious, red, sandy sediment, dietetic treatment will improve the condition, but alkaline mineral waters as French Vichy should also be administered, a glass an hour before each meal. Dietetic treatment, according to Williamson, should be conducted as follows:

1. In the mildest cases, withdraw all carbohydrates for a few weeks, then allow a little bread and, after two weeks more, a little more carbohydrate food.

2. In the less manageable mild cases exclude carbohydrates for six or eight weeks, then allow, if possible, a little carbohydrate food; if not, continue to exclude carbohydrates as long as the patient improves, and when he ceases to improve, relax the diet to a point where not over 500 or 600 grains of sugar daily are passed.

Use fatty food freely when the patient is put temporarily on a rigid diet for diagnostic purposes.

In stout persons, reduce the total quantity of food, and especially of the nitrogenous food, but in emaciated patients do not attempt this.

From the above it can generally be determined whether the case is severe or mild. In two cases, however, treatment has shown that the division of the disease into these two classes cannot be made, since one severe case finally, after some months, became mild, and one mild case after, a year, became severe without any warning.

If the case is a mild one, hygienic and dietetic treatment is prescribed, as given below, with whatever remedies seem suitable. If the ferric chlorid reaction is present, the diet is to be less strict and largely to include fats.

Many writers advise against a sudden change in the diet, from the mixed to the strict, but suggest that first one article of diet and then another be discontinued.

In cases where the ratio of urea to phosphoric acid is found to be persistently high (above 13 to 1) dietetic treatment alone will not suffice. The bowels must be regulated carefully and Phosphorus in some form administered.

In severe cases (those in which the exclusion of carbohydrates does not result in the disappearance of sugar and where emaciation is marked) allow a moderate quantity of carbohydrates (potatoes and bread in small quantities) and give fatty foods freely; also codliver oil and a little alcohol to aid the digestion of the fats. Cream is also allowable and possibly a little milk. The latter, however, is only desirable when the patient's digestion is feeble.

A diabetic who is gaining weight, even if there is more or less sugar in his urine, is in better condition than one in whose urine there is no sugar but who is losing flesh. In the latter case the patient may better take one hundred to one hundred and fifty grammes (one quarter of a pound) of Graham bread daily.

**The Diet in Diabetes.**—The writer insists that the matter of diet in diabetes mellitus is an important one.

The proper diet for the patient in question and the proper amount of exercise in the open air will accomplish more than anything else with which the writer is familiar.

By all odds the best dietetic method which the writer has used is the following. Allow :

Clam-water.

Fish, but no oysters and no shell-fish.

Meat soups, without flour or milk. Beef juice.

Meats.

The following vegetables only :

Lettuce, spinach, cauliflower, cabbage, onions, water cresses, asparagus tops, cucumbers. The stalks and white parts of lettuce and cabbage are to be avoided. Mushrooms are allowed.

The patient is to eat all the lettuce he can in a day, using sweet oil as a dressing, liberally if the digestion permits, but avoiding the white parts and stalks of the lettuce.

Eggs and carefully made omelet. Butter, cream, salad oil.

Cheese.

Pickles.

*Desserts.* Blanc-mange, made of white of egg, beaten up and flavored with vanilla, sweetened with a little saccharin; gelatin jellies sweetened with a little saccharin.

*Nuts.*—Almonds, hazel-nuts, walnuts, Brazil-nuts, cocoanuts.

A bill of fare from the above may be arranged as follows :

Breakfast : Tea or coffee with cream, eggs, ham or cold meat. Breakfast should be the lightest meal of the day. At eleven o'clock a raw egg with lemon juice, salt and pepper.

*Lunch.*—Tea, eggs, cold meat, lettuce and oil, cheese ; beef juice if necessary.

*Dinner.*—Clam-water, or animal broths without flour, fish with butter, hot meat with greens, spinach or cauliflower, let-

tuce and sweet oil, light claret or Budai wine in small quantity, almonds. The patient, if used to tobacco, should smoke a light cigar immediately after each meal. In the writer's experience this is an excellent palliative.

*Drinks.*—The patient while on the diet as above is, if constipated, to drink French Vichy water, one glass one hour before each meal, or, in cases in which thirst is a feature or which are of long standing, two glasses, hot, half an hour apart before meals and bed-time. The influence of hot drinks upon the portal circulation is well known. The power of Allouez water, taken hot as above, in quenching the diabetic's thirst is remarkable.

Bass' ale contains no glucose, but, according to recent analysis, a small quantity of maltose (0.86 per cent.) and some little dextrine (1.26 per cent.) may be present, so that those who drink it should observe the action, if any, on the urine.

Other drinks are a little brandy, cognac or old whiskey, Hungarian, Carlowitz or Budai wine; lemonade from fresh lemons, sweetened with saccharin; water containing dilute acids.

**Regulation of the Diet.**—No bread at all is at first allowed. At the end of three or four days or a week it will be found that the sugar in the urine has decreased materially, after which a maximum of four ounces of white bread daily may be allowed. Later a baked potato at dinner and an apple daily. Even in cases where the patient insists on gluten bread or cakes made from diabetic flour, this diet is effective, provided at the same time exercise in the open air is methodically taken.

For the first two days this diet is arduous, but the patient soon begins to feel so much better that the advantage of it is appreciated. In rare cases—once only in the writer's experience—although sugar is very materially reduced in amount in the urine, the patient feels weaker than before. In the one case in which this occurred the patient was closely confined

in an office, could not or did not take out-of-door exercise methodically and, moreover, showed in his urine an abnormally high ratio of urea to phosphoric acid, always above 15 to 1. Daily regulation of the bowels and administration of hypophosphites (without sugar) soon overcame the weakness, and the patient can now eat more freely without increasing the sugar.

The diet above described must not be continued too long. As already specified, at the end of a week bread, in small quantity, a baked potato, an apple or, in some cases, a peach may be added. The urine must be tested to see whether these articles increase the amount of sugar; if not, the patient can then, as a rule, be put on the following diet:

*Shell-fish and Fish.*—Oysters cooked in any way without milk or flour. Clam-water. All kinds of fish, but sauces should contain no flour. Soft-shell crabs and fish-roe for those with whom they agree; the same may be said of fish-balls (made without potatoes or flour), shrimps, craw-fish, caviare, sardines.

*Soups.*—Consomme (beef, veal, chicken or turtle), with asparagus points, okra, ox-tail, turtle, terrapin, oyster or clam, but all without flour or milk; mock turtle soup, mulligatawny, tomato, gumbo fillet. Beef tea.

*Meats.*—Beefsteak (with or without fried onions, according to digestion), broiled chicken, lamb chops, tender mutton chops, roast beef, roast mutton, game (for those with whom it agrees). Tongue, sweetbreads, lamb fries. Poultry should not contain dressing made of bread or flour; currie should not be thickened with flour. (No liver allowed.) Meat broths, extracts, somatose.

*Vegetables.*—Lettuce, spinach, *cauliflower*, *cabbage*, tomatoes, *radishes*, oyster-plant, celery, *onions*, string beans, water cresses, sorrel, mushrooms, asparagus tops, endives. (Those in italics should not be given to patients whose digestion is weak.)

*Relishes.*—Pickles, sardines, anchovies, olives. (Not to every patient, but according as they agree.)

*Eggs.*—Poached, scrambled with a little chipped beef, soft boiled; carefully made omelet or ham omelet in small quantity, eaten when warm. (In some cases omelets do not agree.)

*Substitutes for Sweets.*—Brandy peaches, without sugar; wine jelly, without sugar; kirsch and rum jellies, without sugar; glycerin, saccharin. If saccharin is used with tea or coffee, add it before cream. A single grain suffices for a cup of coffee. Too much saccharin should be avoided. Many do not like it, and in some it causes serious gastric troubles.

*Miscellaneous.*—Butter; cheese, if not too constipating; salads and salad oils, except potato salad; lean patients, whose digestion is good, may take considerable fat. Sauces to be made without flour or sugar; if to be thickened, use gluten flour. Cream is allowable.

*Desserts.*—Blanc-mange, made of white of eggs, beaten up and flavored with vanilla, sweetened with a *little* saccharin. One apple, not sweet. A few almonds, hazel-nuts, walnuts. Cheese, cranberries, strawberries, plums, cherries, lemons; if stewed, add a little sodium bicarbonate.

*Bread.*—Gluten bread, sparingly used. In cases where the patient is grievously disappointed in giving up bread, allow him ordinary bread in *small quantity*, as a psychical measure. But if the loss in sugar overbalances the psychical gain, be sure to cut off the ordinary bread at once. The various gluten and diabetic flours usually contain more or less starch and should be sparingly used, but can be allowed in greater quantity than ordinary flour. If the patient does not like the gluten flour, he may usually be allowed two to four ounces of wheat bread daily.

He may also try peanut flour, which is best utilized in the form of German pancakes. It is sold by Burnett & Co., India Street, Boston. (See also Dietetic Specialties.)

*Diabetic baking-powder biscuit* may be made by mixing

gluten flour and diabetic flour in equal proportions, with addition of an egg and not too much baking-powder. To be eaten cold.

If the patient eats bread the best forms are rusk, rye-bread and the crust of French rolls.

The dietetic treatment alone, according to Stern, suffices for all patients exhibiting the usual symptoms of diabetes mellitus, whose urine is free from acetone, diacetic and beta-oxybutyric acids, until all symptoms have completely subsided, or until all symptoms except glycosuria, which meantime has declined to less than one per cent., has disappeared.

**Analysis of American Food Products.**—The following table shows the percentage of carbohydrates in various articles of food:

	Per cent.
Salt mackerel, canned in oil, . . . . .	1.1
Clams, long, in shell, . . . . .	1.1
Clams, round from shell, . . . . .	5.2
Lobsters, whole, . . . . .	0.2
Oysters in the shell, . . . . .	0.7
Scallops as purchased, . . . . .	3.4
Shrimps as purchased, . . . . .	0.2
Whole milk, . . . . .	5.0
Skim milk, . . . . .	5.1
Buttermilk, . . . . .	4.8
Cream, . . . . .	4.5
Brie cheese, . . . . .	1.4
Pineapple cheese, . . . . .	2.6
Roquefort cheese, . . . . .	1.8
Whole milk cheese, . . . . .	2.3
Skim milk cheese, . . . . .	2.2
American pale cheese, . . . . .	none
American red cheese . . . . .	none
Meals (various), . . . . .	75 to 79.
Macaroni, etc., . . . . .	73.
Asparagus, . . . . .	0.7
Beans (string), . . . . .	9.4
Beans (dried), . . . . .	59 to 67.
Beets, . . . . .	7.7
Brussels sprouts, . . . . .	3.7
Cabbage, . . . . .	4.9

	Per cent.
Carrots, . . . . .	7.4
Cauliflower, . . . . .	6.0
Celery, . . . . .	3.0
Corn (green), . . . . .	14.1
Cucumbers, . . . . .	2.1
Eggplant, . . . . .	5.1
Greens, . . . . .	8.9
Leeks, . . . . .	5.0
Lentils, . . . . .	58.6
Per cent.	Per cent.
Lettuce, . . . . .	2.7
Onions, . . . . .	8.9
Parsnips, . . . . .	12.9
Peas, green, . . . . .	8.0
Peas, dried, . . . . .	61.5
Peas, sugar, green, . . . . .	8.0
Potatoes, boiled, . . . . .	22.3
Potatoes, sweet, . . . . .	23.1
Spinach, . . . . .	3.1
Tomatoes, . . . . .	3.9
Turnips, . . . . .	6.1
Apples, . . . . .	12.4
Bananas, yellow, . . . . .	13.7
Blackberries, . . . . .	7.5
Figs, fresh, . . . . .	18.8
Grapes, . . . . .	13.3
Oranges, . . . . .	7.1
Pears, . . . . .	10.6
Pineapples, . . . . .	9.7
Pineapples canned, . . . . .	36.4
Prunes, fresh, . . . . .	17.4
Raspberries, . . . . .	12.6
Strawberries, . . . . .	6.1
Dried fruits (such as apricots, dates, figs, prunes, raisins, etc.), . . . . .	59 to 75.
Cocoanuts, . . . . .	31.5
Peanuts, . . . . .	16.3
Chocolate, . . . . .	26.8
Cocoa, . . . . .	37.7
Almonds, . . . . .	3.0
Mushrooms, . . . . .	1.7

From these tables it will be seen that articles containing five per cent. or less of carbohydrates are salt mackerel, canned in oil; long clams in shell, lobsters, oysters, scallops, shrimps, whole milk, skim-milk, buttermilk, cream, cheeses, asparagus, sprouts, cabbage, celery, cucumbers, leeks, lettuce, spinach and tomatoes. Of these those containing three per cent. or less are salt mackerel, canned in oil; long clams, lobsters, oysters, scallops, cream, cheeses, asparagus, celery, cucumbers, lettuce and spinach; the last a little over three per cent.

**The Use of Substitutes for Sweets.**—The patient should be urged to give up the use of glycerin or saccharin as a sweetener.

In the writer's opinion diabetics are addicted to the use of sweets and cannot be depended upon to avoid them as long as they use any at all.

The writer is rather skeptical about the observance of diet by diabetics. A diabetic will diet scrupulously for a few days, especially when he is alarmed, but is likely, except early in the disease, when the will-power is unimpaired, to indulge himself in forbidden articles, so that in the long run the diet is at best only relatively adhered to.

Patients who have had diabetes for years seldom pay much attention to diet. The disease slowly progresses, the substances causing the ferric chlorid reaction appear in the urine and then the diet is powerless to save them.

It will be noticed that in neither of the above diet lists is milk allowed. The writer's experience with milk is that it increases the sugar and the amount of urine voided.

**Resumé of Dietetic and General Treatment.**—The points insisted on by the writer may be summarized as follows:

1. There are two classes of diabetic cases considered with reference to the ferric chlorid reaction; unmanageable cases and more or less manageable ones.
2. Patients easily alarmed are more manageable than those who are not.
3. In the treatment of diabetes mellitus regard must be had for the addiction to sweets. All persons fond of sweets are not diabetics, but nearly all diabetics are fond of sweets.
4. Fondness for sweets leads to ingestion of articles containing glucose itself.
5. The diabetic diet should be supplanted after a short time by diet for the diabetic in question.
6. After sugar is reduced to one per cent. the diabetic should be allowed to eat anything which fails to increase the amount of sugar in the urine, always excepting all sweet things. Even if the patient can eat cane-sugar he should not be allowed to do so for reason explained in 4 above.

7. Glycerin and saccharin should be prohibited for the same reason.

8. Certain green vegetables, as spinach, lettuce, etc., should be insisted on, not merely recommended.

9. Hot alkaline mineral water, especially if laxative, is undoubtedly of value taken before meals.

10. Moderate exercise in the open air should be insisted on. Trips to Carlsbad, without stay in Paris or London, are to be recommended, whenever convenient, in mild cases, but not in the severe ones.

**III Effects of Diet.**—In some of the more severe cases of Class 2a the patient may be found to lose weight rapidly on a rigid dietary. In such cases Williamson finds that the diet must be relaxed so that the patient voids about five hundred grains of sugar daily. If the diet does not decrease the amount of sugar and at the same time the patient loses weight or is generally worse, then there must be allowed bread and milk, fatty food, and especially cream and butter.

If the patient steadily loses ground under dietetic treatment or if long-continued dietetic treatment cannot effectually bring about cessation of the symptoms, then the diet must be abandoned and reliance placed on drugs alone. The same may be said when the amount of sugar is less than one per cent. and some other disorder is present, or in which continued mental excitement brings about a recurrence.

In cases where the patient for any reason cannot observe dietetic and hygienic measures drugs must be given in addition to whatever other measures he can execute.

**Dietetic Specialties.**—Hard-boiled eggs with plenty of butter, omelette. Custard made of eggs and milk, or better as follows: One egg beaten up well, to which is gradually added a mixture of cream and water boiled, the mixture being stirred when added. Place in a pan over the fire and keep stirring until thick, then pour into a glass. Do not let the mixture boil. Flavor with cinnamon and sweeten with saccharin if desired.

Dr. Williamson has prepared an artificial milk, practically free from sugar, which he says may be taken in unlimited quantities by diabetic patients in all forms of the disease. Four tablespoonfuls of cream are added to a pint of water and well mixed; the mixture is allowed to stand in a cool place and at the end of twelve hours the fat of the cream will have floated to the surface and can be skimmed off; to this are now added water, the white of an egg and a little salt, and, if desired, a trace of saccharin. By practice an artificial milk can thus be prepared modified to suit the patient's taste.

Cream itself may be taken to the amount of nearly a pint daily, in small quantities at a time. An emulsion of peach-kernel oil free from prussic acid may be made by mixing the oil, fifty per cent. by volume, with yolks of eggs, elixir of saccharin, spirit of chloroform, the yolk of egg, and almond and cinnamon essences. It is much more palatable than cod-liver oil. A very useful fat emulsion is that of Russell.

Mannite or manna sugar may be given with coffee in amount not to exceed thirty grains daily.

Saccharin and saxon can be used as sweeteners for various articles of diet.

Peaches, apricots and melons are the least objectionable fruits; also stewed green gooseberries.

Nuts, except chestnuts, are allowable.

If potatoes are greatly craved they may be allowed in small quantities cooked as potato chips. A potato "cure" has recently been advised.

Substitutes for bread are the following:

*Torrefied bread*, made by toasting thin slices until they are almost black.

*Gluten bread*, which does not give a deep blue black color with a drop of Lugol's solution (iodine in solution of potassium iodide).

Gluten bread is made by mixing one pound of flour with about a pint of water, placed, immediately after mixing, in an

oven heated to 430° F. Loaves should be baked an hour and a half and rolls three-quarters of an hour. Flavor with a little salt before baking.

Gluten pudding may be made by baking a batter of eggs, cream and gluten flour. Gluten pancakes are made by adding the flour to one or two eggs and beating into a batter; sweeten with saccharin or glycerin.

*Almond cakes* can be made by mixing one pound of ground almonds, four eggs, two tablespoonfuls of milk and a pinch of salt. Beat up the eggs first, then stir in the flour. Bake for about fifteen minutes at a moderate heat. A pudding can be made by using two eggs, one quarter-pound almond flour and one quarter-pound butter.

Ebstein's aleuronat bread contains considerable starch; Williamson, therefore, prefers cakes and buns made out of cocoanut and aleuronat, which he highly recommends. The sugar must be removed from the desiccated cocoanut powder by fermentation. Two ounces of aleuronat, two of cocoanut, one beaten-up egg and a little water sweetened with saccharin make the cakes. To make the buns proceed as follows:

Two ounces of desiccated cocoanut powder are mixed with a little yeast and water and kept in a warm place (by the fire) for fifteen to twenty minutes. Then two ounces of aleuronat are mixed well with one teaspoonful of baking powder and a little salt. After the action of the yeast the cocoanut powder is added to the aleuronat, together with one egg beaten up, and water (sweetened with saccharin or saxon, if preferred). The mixture is worked into a thin batter, and this is then placed in deep tins or tart dishes, which are put at once into a hot oven for twenty to thirty minutes. When half baked the buns or rolls may be glazed with a little egg-albumin and then placed in the oven again until browned. The above directions indicate the proportions of the substances, but, of course, large quantities can be employed.

*Aleuronat Pancake.*—Take one egg, beat up in a little

water and cream ; take two tablespoonfuls of aleuronat powder ; add half a teaspoonful of baking powder and a pinch of salt ; mix well, then add gradually to the egg and cream, and beat into a batter ; allow to stand five minutes. If too thick, add a little more cream and water.

Fry as an ordinary pancake, in a frying-pan with a little lard. At the end of about eight minutes, when the under surface is browned, turn it over and continue to heat for about five minutes longer.

*Aleuronat and Suet Pudding.*—Take two ounces aleuronat flour, two ounces suet, one egg, a pinch of salt, half a teaspoonful of baking powder. Sprinkle a little aleuronat flour on a chopping-board. Chop the suet on this part of the board. Then mix all the aleuronat with the chopped suet in a basin. Add the salt and baking powder. Beat up the egg in about three tablespoonfuls of water, to which a little saccharin has been added. Then add the egg gradually to the mixed aleuronat and suet, stirring the whole mass well into a paste. The addition of a little more water may be necessary. Drop into a tin pudding mould, smeared with butter or lard, and float it in a pan of water, and boil for two hours, taking care that the water does not flow over into the pudding mould ; or, better still, the pudding may be baked in the oven. The addition of almonds (half-ounce) improves the taste. It can be eaten with a little red wine as a sauce.

Use six or seven ounces of ordinary white flour, the same of aleuronat, five ounces of the best butter, one teaspoonful of salt, three-quarters of an ounce of baking powder. Mix the flours in a warm dish, gradually add the melted butter and lukewarm milk, then the salt, and finally the baking powder. Mix well and bake at a good heat.

Mixed fats (Russell emulsion) is flavored with cloves, which to a few patients is unpleasant. It should be taken in plenty of very hot water.

Suet may be freely used in various articles of diet.

A little alcohol remedies the tendency to indigestion when fats are taken.

In cases of fatty stools, fats can not be digested in large quantities.

Diarrhoea due to diet rich in fat should be treated with Bismuth, Calcium carbonate and Opium if necessary.

Cocoanut dishes are as follows :

Three tablespoonfuls of cocoanut powder are mixed into a paste, with a little German yeast and water. The mixture is allowed to remain by the fire, or in a warm place, for about twenty minutes, until fermentation occurs, and it becomes "puffy." Then a little of a watery solution of saccharin is added.

One egg is beaten up, and this, with two tablespoonfuls of cream and a little water, are added to the cocoanut paste. The whole is well mixed and dropped into small tins, and baked in an oven for about thirty minutes.

These cakes are excellent, but contain so much fatty material that in many persons they cause slight dyspepsia. This may easily be prevented by taking a little wine, or alcohol in some form, soon after eating the cakes. (Williamson.)

Saundby gives the following directions for the preparation of cocoanut and almond cakes :

Three-quarters of a pound of the finest desiccated cocoanut powder, one-quarter pound of ground almonds, six eggs, half a teacupful of milk. Beat up the eggs, and stir in the cocoanut and almond flour. Divide into sixteen flat tins, and bake twenty-five minutes in a moderate oven.

*Aleuronat* now used in the preparation of diabetic foods is wheat albumin.

Ebstein has recently recommended another vegetable albumin, ergon from rice, and Pickardt roberat from corn.

Treatment of Prodromal Stage of Diabetes.

In the prodromal stage of Stern his treatment is merely to diminish the food-supply, prohibiting only alcoholic drinks

and especially malted beverages, but insisting on regularity of meals. He commends milk and American cheese, particularly the latter. The writer has found in several instances that a rigid diabetic diet for thirty days will cause disappearance of sugar, loss of flesh, and improvement in the general condition of the patient. At the end of that time the usual diet may be resumed, but the amount of food must be barely enough to satisfy the craving and sustain the strength.

Stern believes in a radical change of climate for the person in the preglycosuric stage. The changed external conditions bring about a regeneration, and if an eventual deterioration has not progressed beyond a certain point, the regained vital energy will in many instances do away with functional disturbances and ward off or even prevent molecular death.

Stern advises air-baths. The patient sits, undressed, in a room (which is warm enough to prevent a feeling of chilliness, but not purposely heated), or, better, performs gymnastics.

The *remedies* which the writer uses in the prodromic stage are chiefly digestive powders, Carlsbad sprudel salts, and hepatic stimulants. If necessary Arsenicum, Uranium nitrate, or Aurum.

*Sodium glycocholate.*—The indications for the use of this substance are hepatic insufficiency, as evidenced by the dirty brownish discoloration of the skin, often associated with a slight yellowness of the eyeball, while on urinary analysis traces and sometimes more than traces of bile pigment can be detected, pointing to a deficient elimination of bile pigment by the liver, the presence of an excess of urinary pigments, urosein, ethereal sulphates, indol and increased proportion of neutral sulphur as well as clinical symptoms pointing to an hepatic insufficiency. The dose is 5 to 15 grains three times daily.

## MEDICAL TREATMENT OF DIABETES MELLITUS.

**Symptomatic Treatment.**—The following remedies are often indicated:

*Arsenicum*.—In the writer's experience this is the principal remedy and is best given in the second decimal. The indications are insatiable hunger and unquenchable thirst, emaciation, loss of strength, pallor, disposition to gangrene, dryness of the mouth and throat, great polyuria, watery diarrhoea, slight motion causes dyspnœa with palpitation and fainting. Cowperthwaite uses the Iodide of Arsenic in the third decimal.

*Creosote*.—Heaviness, drowsiness, depression of spirits, head confused and dull; very severe chronic neuralgic troubles. Use first decimal or drop doses of the crude drug.

*Phosphoric acid*.—Of value when the case is evidently of nervous origin; when there is loss of fluids, particularly seminal; patient is indifferent to all things; long-lasting diarrhoea. Use the first decimal.

*Uranium nitrate*.—Languor, marked and general. Excessive thirst. In cases originating in dyspepsia or digestive derangement. To be given in the lower potencies, or one-grain doses of the crude drug.

*Bryonia*.—Dryness of the lips and tongue, persistent marked bitter taste in the mouth, invariably aggravated shortly after eating, or even drinking. Quantity of urine not so great, but specific gravity high. Pruritus vulvæ. Sleep disturbed and unrestful. Often loss of appetite and marked debility.

*Lactic acid*.—Immense quantities of urine, inordinate thirst and hunger, gastric symptoms marked (acidity, sour burning risings), marked intermittent protrusion of the eyeball and great dilatation of the pupil.

Morning urine contains but little sugar; afternoon and evening much.

*Lithia*.—For the pains in the head, chest, back and joints the writer uses ordinary Lithia tablets, five grains in water, twice to four times daily, or Lithium benzoate in 2- to 10-grain doses.

*Chionanthus* is indicated when there are the following symptoms: Intense thirst, specific gravity of the urine, 1030 to 1040, frequent and copious urination, more or less nervous prostration, loss of weight, night sweats and, in a large percentage of cases, constipation and stool void of bile, being white in color.

Waterhouse says:

"Where there is no febrile condition and nervous depression Lloyd's specific *Nux vomica* should be combined with *Chionanthus*. I prescribe *Chionanthus* in from ten to fifteen drop doses, and the *Nux* in from one-half to one drop doses, when combined, four times daily. The bowels should be flushed every morning, one hour before breakfast, by drinking one to two pints of hot water, to which should be added one-half to one teaspoonful of Sulphate of Magnesia, or, what is preferable, one-half to one wineglass of French Lick Pluto water in one pint of hot water. This line of treatment should be continued until the specific gravity of the urine is normal."

In addition to the above, *Argentum nitricum* (Cowperthwaite uses the thirtieth), *Asclepias vincet*. in gouty cases; *Lactuca*, *Helonias*, *Natrum sulphuricum*, *Kali carbonicum*, *Nux vomica*, *Plumbum* (when complicated with nephritis), *Leptandra*, and many other remedies have been used or suggested.

The writer uses *Arsenicum*, *Phosphoric acid* and *Uranium nitrate*, but is unable to attribute favorable results entirely to these remedies, as dietetic and other measures, without any remedies at all, have done just as well.

**Palliative Treatment.** — Williamson concludes that the drugs which appear to be most deserving, if tried, are *Opium*,

Codeine, Morphine, Arsenic, Antipyrin, Sodium or Bismuth salicylate, Jambul, Uranium nitrate, Cod-liver oil; to which add brewer's yeast, or Cerevisine, the Lecithins, Aspirin, and Hydrastis.

*Opium*.—Diabetics sometimes tolerate this drug remarkably well. It is useful in controlling thirst, and is indicated for restlessness and sleeplessness. *Codeine*, with rigid diet, may be given in one-half grain doses three times daily, and usually can be rapidly increased in amount until fifteen or even thirty or forty grains *per diem* are taken; it should then be gradually withdrawn. In some cases *Codeine* fails to relieve the symptoms described above. The *Extract of Opium* may then be tried, beginning in one-quarter grain doses, three times daily, and slowly increased to four or eight grains in the twenty-four hours; some patients may tolerate even ten grains *per diem*.

*Laudanum* in doses of from sixty to one hundred drops a day in three doses, is said, by Strümpell, to give good results without apparently affecting the bowels.

Opium is bad when it causes constipation, when coma threatens and when there is nephritis.

Williamson states that he has had better results with Opium or *Codeine* than with any other drug.

Morphine, if given, should be by the mouth, in doses of one-sixth of a grain three times a day, until the patient is able to take one grain three times daily without ill effect, until fifteen or twenty grains are given three times daily, discontinuing every three or four weeks for a few days, and resuming again. West reports in all eight cases helped by it.

*Quinine* may help malarial cases.

*Mercuric chlorid* is highly recommended by Dr. I. N. Danforth, of Chicago. He gives it in doses of from one-tenth to one-fourth of a grain.

*Arsenic*.—As a routine practice *Arsenicum*, either alone or in combination, is perhaps the most frequent prescription

given to diabetics. Combined with bromine in the form of *Clemens' Solution* it is given in five-minim doses, or more after tolerance.

The Arsenite of Bromine in one-sixteenth of a grain, increased to one-sixth, may be used instead. The Arsenite of Iron in pill form, in doses of one-sixteenth of a grain, is recommended in cases complicated by anaemia or malaria. The dose may be gradually increased to one-eighth or one-sixth grain.

Fowler's Solution, in drop doses or more, is sometimes given.

The Bromides of Arsenic and Gold, in the preparation known as Arsenauro, are credited with cures.

The writer as yet, however, has been able to manage his cases by means of diet, exercise and hot alkaline waters, without the use of crude drugs except as a last resort.

Extensive trial of Arsenical preparations by various physicians has resulted in skepticism as to their value.

*Antipyrin* may be useful for the pains in the limbs, but otherwise is of doubtful value and may do harm to the digestion and kidneys if given too long. The dose is from 30 to 60 grains daily. The writer has not as yet used it.

Osler advises it in neurotic cases in doses of ten grains three times daily.

*Jambul*.—This agent appears to have the power to diminish the secretion of urine. The fluid extract of Java jambul should be used, given in capsules of ten minimis each, one capsule three times daily, increased to four or five capsules at a dose. The seed of jambul should not be heated in the manufacture of the fluid extract.

The writer has seen several cases in which this drug acted favorably so far as controlling the secretion of urine is concerned.

*Sodium salicylate* may be of service in gouty cases. The dose is from ten to twenty grains daily. *Aspirin* may be preferable.

*Sodium bromide* may be given in doses of fifteen to twenty grains, well diluted, in cases where there is great nervous irritability or excitement.

*Uranium nitrate* may be of considerable value. The dose is from one to two grains, well diluted, twice a day, after meals, increased every few days.

*Oxygen*.—Inhalations of from three to five gallons daily may be used, diluted with an equal volume of atmospheric air and inhaled slowly and deeply, half a minute or so of rest being allowed between each inhalation.

*Benzosol* as an intestinal antiseptic, together with Carbonate of Lithia and Fowler's solution, is said to help some cases of diabetes.

*Acetozone* may become useful like the above.

Other remedies sometimes indicated are: *Nitric acid*, in early stages, when there are crops of boils; *Graphites*, *Lep-tandra*, *Podophyllum*, *Aurum muriaticum*, *Maté*.

*Anti-syphilitic* treatment by Mercurial inunction and ten grain doses of Iodide of Potassium may be of service when a history of syphilis preceding diabetes is to be had. But mercurial stomatitis and dysentery may be caused by the mercurial treatment or other and fatal complications, as gangrene or pulmonary tuberculosis.

*Lactic acid* and *Methylene blue* have been used with claimed success.

*Cod-liver oil* should be used, as well as *Lipanin*, peach-kernel oil, Petroleum emulsion and Russell's emulsion in emaciated cases.

The frothy part of fresh yeast has sometimes produced good results. Brewer's yeast is also worth trying, or *Cerevisine*.

Pancreatic extract is probably of no value. Pancreas grafting may possibly be of service.

*Raw calf pancreas* helped one of Dr. R. H. Fitz's cases.

The rectal injection of *extract of liver* and *thyroid extract*, internally, in small doses, has also been tried in this country.

**Special Therapeutics.**—In the writer's experience drugs have but little or no curative action when the disease is once chronic. Palliative treatment for the various symptoms which give most distress is to be pursued as follows:

*For the Pains.*—Those which are usually in the head, chest, back and joints the writer finds relieved by the salts of Lithium, as Lithium benzoate in 2- to 10-grain doses. For lancinating pains Codein is palliative in  $\frac{1}{8}$ -grain doses. Antipyrin, 10 grains in an ounce of peppermint water, three times daily, for gnawing pains in the legs is recommended.

*For the Constipation.*—A teaspoonful of Carlsbad Sprudel salt in a glass of hot water an hour before breakfast. In some cases the faeces may have to be removed by more vigorous measures, so dry does the mucous membrane become. In mild cases Kutnow's powder acts well and is pleasant to take.

In one or two severe cases of constipation Rubinat water was found efficacious by the writer. It may be necessary at times to give Mercurius dulcis, followed the next morning by aperient water.

*For the Depression of Spirits.*—The chief remedies are Arsenic and Aurum, particularly the latter, in the lower potencies.

*For the Insomnia and Debility.*—The writer uses Phosphoglycerate of Lime in doses one capsule (4 grains) (not the wine nor the syrup) three times daily. Sometimes, also, the hypophosphites without sugar, or a phosphorus and calisaya mixture without sugar. The various Lecithins may be tried.

Two teaspoonfuls of good beef-juice in water are serviceable when the patient wakes up hungry at night or "gives out" in the afternoon before dinner. Unfortunately the salty taste prevents many patients from taking this nourishing article. Somatose may, therefore, be serviceable in such cases.

*Diarrhœa.*—When attacks of diarrhœa come on the pa-

tient may subsist on beef-juice and barley-water for the time, and take Salicylate of Bismuth, eight grains twice daily.

In diabetic steatorrhœa Wegele advises use of Pankreon.

*For the Thirst.*—Hot alkaline mineral waters, two glasses, half an hour apart, before each meal and before going to bed. In gouty cases this treatment sometimes reduces the sugar to a trace or causes it to disappear altogether.

The writer uses Allouez water, as stated above. Chewing roasted coffee sometimes relieves thirst. Water acidulated with lemon juice or acids may be used.

*Accidents.*—In cases of accidents involving concussion of the brain and followed for considerable time by notable slowness of the pulse, all mental excitement and exposure to excessive heat of the sun should be avoided for a year.

*Mouth-Wash.*—For the disinfection of the mouth a solution of Chlorate of Potassium, 1 in 19, is made, and a tea-spoonful of this added to a pint of water to which a little alcoholic solution of thymol is added. The mouth is well-rinsed with this mixture several times daily.

A weak solution of Boric acid or of Borax in camphor-water may be used, or Borax, two drachms; Boric acid, one drachm; Potassium chlorate, one drachm, mixed and dissolved in twenty fluidounces of camphor-water. A three per cent. solution of Bicarbonate of Sodium is used for a mouth-wash; also a solution of Aluminium acetate, one part, in water two hundred parts, after each meal.

*Gastric Disturbances.*—The writer has used Taka-diestase and Caroid. Waterhouse advises Lloyd's Asepsin in solution, four grains to the ounce, together with Subnitrate of Bismuth. Pancreatic extract after each meal may be useful. Williamson has found ten grains of Bicarbonate of Sodium in a tea-spoonful of milk of service for the dyspepsia.

Roberts, for the craving for food and sinking at the epigastrium, gives two or three grains of Asafoetida in a pill, two or three times a day.

*Itching of the skin* requires warm baths, frequent sponging and regulation of the bowels. Savill's prescription is as follows :

B. Calcii chloridi,	20 to 40 grs.
Tincture Aurantii,	5 <i>i.</i>
Aquaæ chloroformi,	3 <i>i.</i> t d.s

*Pruritus and eczema of the vulva* are troublesome conditions. After urinating, the patient should dry the meatus with absorbent cotton, and apply chiolin twice daily, or a lotion of Boric acid, or of Sodium hyposulphite, one ounce in one quart of water : or Ichthyol and lanolin ointment ; or an ointment composed of ten grains of Potassa sulphurata, to one ounce of benzoated lard; retain by use of napkin or absorbent cotton.

The parts should first be bathed in warm water, using chiolin soap, then rinsed with clear water, dried gently by pressing with soft, clean towels heated in an oven, after which the chiolin may be applied.

W. S. White, of Chicago, in cases of *eczema*, advises bathing with milk instead of water.

*Corns*.—Williamson points out the danger of cutting corns in diabetic cases, for fear of troublesome trophic ulcers, perforating ulcers, or superficial gangrene.

*Sleeplessness* may require Chloralamide, Sulphonal, Opium, or the Bromides, if there is also much nervous excitement.

*Cutaneous œdema*, not due to nephritis, requires rest in bed and Iron internally.

*Gangrene*.—Fulton reports practical disappearance of sugar from the urine in a case subsequently operated on for gangrene, by use of a tablet composed of Antipyrin, two grains ; fluid extract Jambul seed, two minims ; Codeine sulphate, one-half grain. Before amputation of the member the patient took these tablets for some time. The operation was successful and the wound healed kindly.

For local treatment of gangrene the parts are to be dressed

with iodoform and cotton, and access of air allowed. If there is cellulitis, free incisions should be made. Amputation will be necessary when (1) the fever persists and cellulitis increases, and (2) the glycosuria persists in spite of anti-diabetic treatment.

In cases of gangrene with extensive atheroma, according to Godlee, amputation should not be lower than the knee. When due to neuritis, amputation is not advisable, or, if performed, should be below the knee.

In cases of *eczema of the prepuce* the patient should dry the end of the penis, after each act of micturition, with lint or antiseptic cotton, and employ Boric acid ointment or lotion. It is well to prevent this complication by drying the end of the penis, as above, before eczema appears.

*Cystitis* requires internally Urotropin, Salol or Boric acid, together with washing of the bladder with Boric acid (fifteen grains to the ounce) or of Salicylate (thirty grains to the ounce), to which hot water is added. Helmitol, internally, may be tried.

*Boils and Carbuncles* require lint compresses moistened with Boric acid locally, or antiseptic poultices, as of linseed meal stirred in boiling water, ten ounces, to which two drachms of Carbolic acid have been added.

Brewer's yeast should be tried as a remedy internally, or Quinine sulphate in three-grain doses four times daily.

*Flatulence and intestinal catarrh* may require Fairchild's Pepules of Pancreatin, Nux and Ox-gall, or Creosote or Thymol. The Caroid tablets are particularly good for flatulence.

*Pulmonary tuberculosis* requires a large quantity of fatty food, cod-liver oil, and a small quantity of alcohol. Otherwise, the general treatment is anti-tubercular.

*Arterio-sclerosis*, in association with diabetes, requires regulation of the bowels and the Iodide of Sodium internally.

*Nephritis*, as a complication of diabetes mellitus, requires the following: Nitrogenous food in medium quantity, milk

or Koumiss in large quantity, fatty food freely, bread in limited amount, but no sweets. The remedies are Potassium or Sodium citrate. The bowels should be caused to move freely.

#### DIABETES MELLITUS IN THE SEVERE FORM.

This form is characterized by the appearance in the urine of a substance or substances giving a wine-red color, with solution of ferric chlorid, and by a toxæmia in the patient which terminates in *diabetic coma*. It must be remarked, however, that this red reaction is found in the urine of most diabetics under thirty from the very start. In older persons, however, the reaction may be absent for many years.

**Substances Causing the Reaction.**—According to some authorities the substances present are acetone in excess, ethyl-diacetic acid, and lævorotatory oxybutyric acid.

According to Charles Platt,  $\beta$ -amidobutyric acid,  $\text{CH}_3\text{CH}(\text{NH}_2)\text{CH}_2\text{COOH}$ , together with similar, but as yet undetermined substances is the cause in the blood of diabetic coma and its allied manifestations. This substance is excreted in the urine as  $\beta$ -hydroxybutyric acid. Its presence is due to the destruction of body-albumin.

#### DIABETIC COMA.

**Pathology.**—Only two theories of the cause of diabetic coma appear tenable: First, that of *acidosis* or acid intoxication (Stadelmann), and second, that of a *specific toxæmia* (Klemperer, von Noorden). The second is regarded by A. Mayer as really a continuation of the first.

**Etiology of Coma.**—The etiology is obscure, but certain causes appear to be demonstrable as follows:

1. Fatigue, whether from a long railway journey or excessive muscular exertion.

2. Emotional disturbance.
3. Sometimes from sudden change of diet. It occurs, however, regardless of diet.
4. Prolonged constipation.
5. Exposure to cold ; alcoholic, and sexual excess.
6. Intercurrent affections, as pneumonia, influenza, carbuncles, abscesses.
7. Administration of anaesthetics, surgical operations, occasionally operations for cataract.

**Diagnosis of Coma.**—The premonitory symptoms are as follows :

1. Epigastric pain and nausea.
2. Rapid pulse action.
3. Dyspnoea.
4. Drowsy mental condition, often with restlessness.
5. The red reaction in the urine with ferric chlorid.
6. The small opaque, grayish deposit containing large numbers of grayish granular casts. Fatal coma especially is announced by the presence of these casts.

**Onset.**—Three classes of cases are encountered in diabetic coma :

- (1) The patient becomes weak, has syncope, becomes somnolent and gradually unconscious. In this class of cases death takes place in a few hours.
- (2) The patient has premonitory symptoms, as gastric crises, pharyngitis, phlegmonous affections, or lung troubles ; headache is noticed, followed by delirium, distress and dyspnoea. Death takes place in from one to five days.
- (3) The patient is seized with a sudden headache and dizziness and rapidly goes into coma.

There may be abortive forms with quick recovery, but repeated attacks ensue and prove fatal. In a very large number of cases coma follows exhaustion or over-exercise and is fatal in a few hours, rarely in three or four days. In few cases diabetic circulatory collapse, so called, takes place or leads to

coma. In old persons coma is likely to follow gangrene or carbuncles.

**Clinical Features of the Onset.**—It may be said in general that *any sudden improvement in objective signs not confirmed by subjective sensations on part of patient* should put the physician on his guard; reduction in the excessive appetite to below standard for healthy person; unexpected and unexplained loose movements when constipation has previously been the rule; peculiar fruity odor to breath already described; acid eructations and nausea, with or without vomiting; the patient complains of general prostration and disinclination to exertion; tendency to drowsiness during the day and great despondency; attacks of intense vertigo, frontal headache, neuralgic pains; accelerated pulse, with or without decrease in volume. After a variable period of indefinite symptoms like the above the patient will complain of a feeling of depression, is restless at night, eats nothing, has colicky pains, vomits matters sometimes having fruity odor, has sense of constriction about the thorax, causing deeper breathing than usual; mental condition varies from excitability to mild, talkative delirium, alternating with drowsy or stupid intervals. In some cases there is great anxiety and severe delirium.

The essential features, clinically, are the *gastric crises*, which are followed by great weakness, from which the patient may not rally.

Dr. F. Hirschfeld, of Berlin, thinks that a typical case is easily recognized. A diabetic who has been feeding quite well notices gastric symptoms; a violent headache sets in and a sensation of dyspnœa. These symptoms gradually increase in severity, the respiration becomes deeper and more rapid, the sensorium becomes confused, the patient slowly loses consciousness, and in two to ten days after the appearance of the first symptoms death occurs.

Abortive forms frequently are noticed, where one or more

symptoms are pronounced, so that a suspicion of grave coma is aroused, but the symptoms disappear in a few days. The excretion of acetone is also increased here.

**Clinical Features.** — During coma the following are noticed :

*Dyspnoea.* — A most characteristic symptom, becoming more extreme with increase of the coma, although the number of respirations may be normal or only slightly increased in some cases, or in others respiration may be rapid, deep, and noisy. The patient is sometime cyanotic. The breathing has a peculiar panting or sighing character. There is fruity odor of the breath and urine. The breath is cold. The peculiar odor appears sometime before coma.

*Heart action* much accelerated, pulse small and weak, frequently 120 or 130, and finally, 160 or more. The tension is low. Rapid pulse is regarded as an important early indication.

*Temperature* rarely increased, may sink as low as 86° or even lower. Occasionally it may rise at the last very high.

*Loss of conscious sensation common in all cases.*

*The bowels* are generally constipated, especially before the onset. Occasionally diarrhoea precedes.

*Livid face*, or pale, cold face. The nose, lips and ears are slightly cyanotic and very cold to the touch.

*The pupils* may be normal and may react to the light, though sluggishly. The eyelids are half closed.

*The surface of the body and extremities* may be cold, but the patient, if conscious, may not feel cold. Hands and feet may be slightly cyanosed.

Death may take place in twenty-four hours or less from the beginning of the attack.

**The Urine in Coma.** — The quantity may in some cases decrease and sugar diminish or be absent. The writer has, however, seen cases in which this did not happen until just before death, and in some instances has no record of its hap-

pening at all. But the Bordeaux-red color with ferric chlorid is marked in all cases which the writer has seen.

The ferric chlorid reaction is thus performed by the writer : Take two test-tubes of the same size and pour into one about 4 or 5 c.c. (one fluidrachm) of the diabetic urine and into the other the same amount of normal urine. Make up a 20 per cent. solution of ferric chlorid,  $\text{Fe}_2\text{Cl}_6$ , in distilled water, Using a medicine-dropper with rubber nipple, add three or four drops, but not more, of the 20 per cent. ferric chlorid solution to each of the samples of the urine previously measured out into two test-tubes. (If a graduate is not at hand for the measuring purposes, about an inch of urine in each tube will be a proper amount.)

The ferric chlorid solution should be dropped into the urine slowly, drop by drop, and fairly and squarely, so that each drop hits the urine and not the side of the tube. As the drops sink to the bottom they make a cloudy trail, due to precipitation of the phosphates. After the third or fourth drop has been added the upper and greater part of the urine becomes cloudy, but the bottom part is clear. Now, in normal urine this clear bottom part is a golden-yellow color, but in urine containing diacetic acid the color is a more or less dark-red.

When it is known with certainty that the patient is not taking drugs, the test as above described is sufficient. In these days of analgesic remedies, however, it is not always safe to assume that the patient has not had a finger in the pie of his own treatment. The numerous aches and pains of diabetics are conducive to resort to the various analgesics, and it is precisely these substances which may make the test uncertain.

When, therefore, we are not absolutely certain that the patient is not taking drugs at the time the urine is examined, further procedure is necessary, as follows : Four or five c.c. (about one fluidrachm, or about one inch of urine in a test-tube

of medium size) are measured out and boiled over a spirit-lamp. The ferric chlorid is added precisely as before while the urine is hot, and the mixture immediately filtered. In case the red reaction noticed in the first test was due to diacetic acid and not to drugs, the urine now comes through the filter golden-yellow instead of red, and remains yellow, even after further addition to it while hot of a drop or two more of the ferric chlorid.

If, on the other hand, the red reaction was due to the presence of drugs in the urine, the filtered urine is reddish or will become red after further addition of a drop or two more of the ferric chlorid.

I have made a sufficient number of experiments on the urine of diabetic patients to satisfy myself that the red color due to presence of drugs, as salicylates, in the urine will appear when ferric chlorid is added to the hot urine, but will not appear in the hot urine when the color in the cold was due to diacetic acid. The results of the test may be shown concisely in the following :

A. An inch of cold urine in a test-tube to which are added three or four drops of the 20 per cent. solution of ferric chlorid : (1) If the lower and clearer portion is a golden-yellow color the test is negative. (2) If the lower and clearer portion is reddish or dark-red, either (a) diacetic acid is present or (b) some drug which gives a red color with ferric chlorid, or else other fatty acids, are present.

B. In case the red color appears at the lower part, take another sample of the urine, boil an inch of it in a test-tube, add three or four drops of the ferric chlorid solution, and filter hot : (1) If the urine goes through the filter golden-yellow, and does not turn red when a drop or two more of the ferric chlorid is added to it, *diacetic acid is probably present.* (Further tests may be made as directed on page 233 of my work on the Urine.) (2) If the urine goes through the filter reddish or yellowish-red, or if the latter becomes more red

when a drop or two of ferric chlorid are added to it, diacetic acid is absent, and the original red color in the cold urine was due to drugs or other substances. It is, of course, possible that a patient with diacetic acid in his urine might be taking salicylates or other drugs, in which case the conclusion that diacetic acid was absent would be erroneous. When, therefore, the red color persisting in the hot urine is obtained, administration of drugs should cease until the absence of diacetic acid be assured. In other words, two points are essential to be made in the detection of diacetic acid :

I. A red color when cold urine is treated with ferric chlorid solution.

II. Absence of this red color when hot urine is similarly treated.

After using this test as above for years without notable difficulty, the writer not long ago ran across a case in consultation in which the urine of a diabetic young woman gave the red reaction in *both* cold and hot urine. It was insisted upon that no drugs were being taken by the patient, and she died comatose about two weeks later. Owing to circumstances, I was never able to follow this case up by repeated analyses and ascertain the cause of the apparent anomaly.

The substances other than fatty acids, which yield a similar reaction with ferric chlorid, are the Salicylates, Antipyrin, Thallin, Phenocoll, Salipyrin and Chloralamide. The salicylate reaction is violet or purple, but the other substances give a tint closely resembling that obtained from the fatty acids.

[So many patients take coal-tar compounds that it is highly desirable that some clinical test other than the ferric chlorid should be discovered. Several methods for the detection of diacetic acid in urine have been proposed, notably those of Lipliawsky and of E. Riegler. Riegler's test is comparatively simple: Half an ounce of urine (15 c.c.) is acidulated with from five to ten drops of concentrated sulphuric acid ; further

add two or three cubic centimeters of an aqueous solution of iodic acid; an intense pink color will appear if diacetic acid is present. The color is not taken up by chloroform. It is claimed that this test is reliable and more delicate than the ferric chlorid.]

The *acidity* of the urine undergoes marked increase. A *pinkish color* is sometimes noted. *The odor* is fruity in nearly every case.

A small amount of *albumin* is generally present, and great numbers of *grayish granular casts*.

The urine may be suppressed just before death, and remain so in spite of all treatment.

Williamson and Külz regard the appearance of casts as a valuable premonitory sign of coma. In two cases which the writer has seen casts were found for the first time half a day only before fatal coma.

Forms of coma known as *alcoholic* (resembling alcoholic intoxication) and *diabetic collapse* occur.

In the alcoholic form the patient feels as if intoxicated; his gait becomes unsteady, he becomes drowsy and gradually comatose.

In diabetic collapse the patient suddenly begins to suffer from drowsiness and great weakness; the extremities are cold, the hands, feet and face livid, the pulse quick, small and thread-like, 120 or 130; respirations are shallow, there is not much dyspnea, the temperature gradually falls, the skin becomes covered in some cases with perspiration, the patient becomes more drowsy and finally comatose, and finally death occurs from collapse in ten to twenty hours. *There is no reaction with ferric chlorid* in the urine, nor any fruity odor. It occurs in chronic cases, often associated with gout or nephritis, and is due to mental or physical overexertion or error of diet.

**Differential Diagnosis.**—The fruity odor of the breath and the urine, the red reaction in the urine with ferric chlorid

and the methylene blue reaction of the blood distinguish diabetic coma, especially if the patient is much wasted and sugar is found in the urine in appreciable quantity. In one of the writer's cases four per cent. of sugar was still present in the urine just as the patient was beginning to become drowsy.

A close similarity is offered by poisoning by Salicylic acid in diabetics, yet here the symptoms will only last a few hours.

Again, the attacks of heart weakness which are observed in diabetics after severe exertion may be easily confounded with diabetic coma. However, examination of the urine for acetic, diacetic and oxybutyric acids will be a certain guide as to the condition. This diagnosis is important, as these conditions of exhaustion are more easily treated than the terminal stage of diabetic coma.

A much more difficult task is to decide whether apoplexy has complicated diabetes. For example, Hirschfeld has observed a diabetic in whom apoplectic state with an isolated paralysis was present. The patient had previously had several apoplectic seizures, with isolated paralysis, and examination of the urine revealed neither acetone nor diacetic acid.

Sometimes the abdominal symptoms, obstinate constipation, and vomiting may be so prominently in the foreground that an obstruction of the bowels may be simulated. In all suspicious cases one should examine the urine. A sudden sinking of the blood-pressure may precede, occurring even ten days before death.

**Prognosis.**—This is now unfavorable, and it is usually only a question of time how long the patient will live.

The ferric chlorid test seems to be an important factor in the prognosis, as will be seen by the following table of some of the writer's cases, whose present condition is known with certainty:

Cases.	First Seen.	Ferric Chlorid Reaction.	Present Condition of Patient.
1. Mr. M. . . .	1891.	Absent. None	Alive and attending to business. (1903.)
2. Mrs. G. . . .	Feb., 1895.	Absent. Not found at last examination.	In fairly good health.
3. Mr. P. . . .	Feb., 1895.	Absent	No sugar present. Patient well and attending to business.
4. Mr. K. . . .	April, 1895.	Absent.	Amelioration prompt, but present condition unknown.
5. Mrs. S. . . .	Dec., 1895.	Absent, and not found at any time since.	Alive and in fairly good health.
6. Mr. B. . . .	May, 1896.	Absent.	No record.
7. Mr. C. . . .	June, 1896.	Absent.	Rapid amelioration. Relapse when treatment discontinued. Now better again after resuming treatment.
8. Mr. M. . . .	Sept., 1896.	Absent.	Rapid amelioration. Sugar easily controlled.
9. { Mr. R. . . .	Dec. 23, '96.	Absent.	Patient suffering from gastric crises.
9. { Mr. R. . . .	Dec. 26, '96.	Present.	Died in six weeks.
10. Boy 19 yrs.old	April, 1897.	Present.	Died in June, 1897.
11. Mr. G. . . .	April, 1897.	Absent.	Rapid amelioration. Discontinued treatment, and died in 1899.
12. Mrs. T. . . .	May, 1897.	Present.	No record.
13. O. R., girl of 8	Aug., 1897.	Present.	Died in one year.
14. Mrs. R. . . .	April, 1895	Present.	Died in 1899.
15. Mr. H. . . .	Jan., 1898.	Absent.	Alive.
16. Mr. B. . . .	March, 1898.	Absent.	Rapid amelioration. Sugar reported to be absent.
17. Mrs. M. . . .	1897.	Absent.	Case stationary until writer's mineral-water treatment taken, when rapid amelioration.
18. Mrs. Mc. . . .	April, 1898.	Slight reaction present.	Died, June, 1898.
19. Mr. Mc. . . .		Absent.	Alive.
20. Mr. L. . . .	Sept., 1898.	Absent.	Alive. Rapid amelioration. Sugar absent in less than a week.
21. Boy 19 yrs.old	Oct., 1898.	Present.	Died, March, 1899.
22. Mrs. W. . . .	Nov., 1898	Present.	Died of exhaustion, June, 1899.
23. Mr. E. . . .	Jan. 19, '99.	Absent.	Rapid amelioration. Sugar decreased from 4 per cent. to less than 1 per cent. in a month. In good condition, July, 1903.
24. Mr. B. . . .	Dec. 30, '99	Absent.	Rapid amelioration. Sugar decreased from 5 per cent. to less than 1 per cent. in about a month.

Cases.	First Seen.	Ferric Chlorid Reaction.	Present Condition of Patient.
25. Mr. M. . . .	June 1, 1899.	Absent.	Remarkable amelioration. Sugar decreased from 7 per cent. to $\frac{2}{3}$ of 1 per cent. in 5 days. Died a year later.
26. Boy of 18 . .	Aug. 5, '99.	Present.	Case obstinate. After a month's treatment sugar still 6 per cent. Died in Jan.
27. Mr. M. . . .	Aug. 25, '99.	Absent.	Sugar reduced from 6 per cent. to less than 1 per cent. in a fortnight.

Since writing the above the following has happened :

CASE 26.—A boy, of eighteen, was so convinced that the writer had cured him that he discontinued treatment and went to work. In midwinter, while on a wagon unloading material, he became suddenly unconscious, fell off the wagon, was carried home and died comatose in three days.

CASE 25 was so rapidly relieved as to believe himself entirely cured and hence gave up precautions. As a result from fatigue in sight-seeing he became worse in October, the ferric chlorid reaction appeared and he died of coma about six months later.

Two other cases of interest are not found in the table above : One was a fine, healthy looking young woman whose urine in September showed a slight reaction with ferric chlorid. She improved so much on diet as to believe herself cured and never consulted the writer again. About three months later she became so weak as to be unable to work and gradually sank into coma. The urine passed on the day before death contained four per cent. of sugar, gave a deep-red reaction with ferric chlorid and contained albumin in small quantity and numerous gray granular casts. Suppression of urine took place in this case, no urine being passed in spite of vigorous measures for relief for twenty-four hours before death.

The most hopeful case which the writer has seen is that of a boy, now fourteen years old, whose urine in September, 1901, had the fruity odor of acetone and gave an unmistakeable red reaction with ferric chlorid. By dint of methodical exercise in the open air (horseback riding) and careful dietary the fruity odor and red reaction disappeared in a few months, the sugar came down below two per cent. and at times was wholly absent.

A prominent feature in the diet was *lettuce*, which was given him freely, with olive oil as a dressing. He has gained flesh and strength on a strict diabetic dietary, the only bread allowed being biscuits made from diabetic flour. It is now two years since sugar first appeared in his urine together with the substances giving the red reaction with ferric chlorid.

The case is notable in that it is the only one which the writer has seen in which it has been impossible to obtain the red reaction for a period of months after it was once plainly visible. But the patient has by no means recovered.

After coma sets in death usually occurs in from twenty-four to forty-eight hours. Recovery may take place for the time in some cases, but a relapse will soon take place with fatal termination.

The coma does not, however, pursue the same course in all cases; sometimes the patient may linger several days. Some patients do not have the early stage of mental excitement or anxiety, but become drowsy first, then comatose.

**Treatment.**—When the red action with ferric chlorid is found, great care must be taken not to withdraw carbohydrates from the dietary too suddenly or completely; fatigue from long railway journeys or overexertion generally should be avoided. The trip to Carlsbad should not be advised in such cases. Even as short a journey as from Chicago to Boston proved fatal to one of the writer's patients, who smiled at proffered advice warning against it.

The utmost care should be taken to avoid prolonged constipation in these cases.

As to diet, the quantity of meat, eggs and nitrogenous foods must be decreased, a moderate amount of bread and a small amount of potatoes allowed, fatty food and cream given freely; even milk in small quantities may be allowed, but a milk diet must not be prescribed.

A patient, who came to the writer after being put on a milk diet by another physician, was so weak as to be saved from speedy death only by the most careful measures.

During the gastric crises milk is the only diet possible, mixed with imported Vichy water or taken in form of kumyss.

Mayer thinks well of milk in cases where the patient is drowsy and coma threatening. He allows one quart in twenty-four hours.

In general fatty foods, except during these crises, are to be preferred to the more highly nitrogenous diet usual in earlier stages. Alcoholic drinks, as whisky or brandy, in small quantity (one and one-half fl. oz.) may be of service in aiding the digestion of fatty foods or when the patient has a disgust for fat. The artificial cream above described should be given to patients in this stage.

*The medical treatuent* is as follows: As a rule, the first thing to do is to give a dose of castor oil; if it fails to work a compound jalap powder may be given.

The patient should drink water freely. Prolonged tepid baths are to be recommended. In cases of collapse, Ether, Ammonia, Digitalis, and Alcohol are to be administered. Strychnine, Digitalis, or Ether, hypodermically, are most serviceable. Inhalations of oxygen should tried for symptoms of approaching coma.

When the patient is not yet comatose, but is drowsy and troubled with dyspnoea, alkalies in massive doses should be tried; thirty grains of Sodium bicarbonate in a little milk every three hours and one hundred grains of Sodium citrate three times daily may sometimes prevent coma. The writer

has seen a case in which, however, even these massive doses failed to prevent a rapidly fatal coma, and Williamson says, "Unfortunately, the comatose symptoms usually advance to a fatal termination in spite of alkaline treatment.

*Intravenous injections*, when properly performed, have often a decidedly, though only temporary, beneficial effect after coma has once set in. The solutions used are Sodium chloride alone, with the Phosphate or Carbonate, or with both Phosphate and Carbonate of Sodium ; Sodium bicarbonate alone is sometimes used. Intravenous injections of Sodium chloride alone in the strength of 0.6 to 0.75 per cent. is used. Sodium bicarbonate is used in the strength of 3 to 5 per cent.

In some cases solutions of Sodium carbonate of the same strength have been used. Matthew's solution should be tried in these cases.

Cases have been reported in which intravenous injections used in the early stages of coma have prevented the fatal issue. Lépine used in one case two liters (sixty-six ounces) of a solution containing seven grammes (108 grains) of Sodium chloride and ten (155 grains) of Sodium bicarbonate per liter (thirty-three fluid ounces).

For intravenous injection all the apparatus necessary is a funnel and piece of India-rubber tubing with clips and canula. One of the veins in front of the elbow is exposed, and the canula inserted. It is important that the fluid used should not be cold. The solution of Sodium chloride or Sodium bicarbonate is mixed with an equal quantity of warm water just before being transfused. Lépine recommends that the fluid injected should have a temperature of 100.4° F. The fluid is apt to become cold if kept for a long time in the funnel whilst the vein is being exposed. Hence, it is better to expose the vein first before placing the warm fluid in the funnel and tubing. In place of a funnel a vessel may be used which has a cover, the fluid flowing from the lower part.

For the early stages of coma a vapor-bath given in bed, and powerful stimulants, as Ether, Ammonia, Musk, Valerian, or Camphor, may ward off the attack. Sodium bicarbonate in ten-grain doses may also be given. Intravenous injections of alkaline solutions have been tried, but without success, as a rule. Intravenous injection of normal salt solution in early stages may postpone the attack.

According to Swarz *Glyconic acid* neutralized with Sodium bicarbonate has repeatedly overcome diabetic coma.

Mayer reports a case in which coma was repeatedly combated with success by use of *Urotropin* in doses of from twenty to sixty grains daily. His theory is that the drug splits up into ammonia and formaldehyde in the body and that the ammonia neutralizes the fatty acids in the blood, while the formaldehyde passes out in the urine. He also believes in large doses of alkalies, especially Sodium bicarbonate by all possible channels as much as the patient will stand; as, for example, by mouth, by enema, or by subcutaneous or intravenous injection of a three to five per cent. solution.

In all cases in which the red reaction with ferric chlorid is obtained, Naunyn suggests that Sodium bicarbonate be given daily for a long time in doses of from ten to twenty grammes (two to five drachms) per twenty-four hours.

During the coma itself luke-warm baths and douching may be tried with hypodermics of Camphor or Ether.

McCaskey, of Fort Wayne, believes in daily antiseptic irrigations of both stomach and colon with intragastric faradism, abdominal massage, and general hot and cold douches.

Guiranna (*La Clinica Medica*, An. 5, n. 19) speaks very highly of a diet of fresh vegetables in the treatment of diabetes. In bad cases he finds that much benefit is derived from an exclusive diet of fresh vegetables for a few days, but in ordinary cases a mixed diet is sufficient. The vegetables recommended are endive, cabbage, French beans, artichokes, and in general all green vegetables. Peas and beans, pro-

vided they be fresh, may be taken in small quantities ( $\frac{1}{4}$  kilogramme). He also allows fruits in moderation. The only saccharine substance allowable is levulose, from 50 to 200 grains a day. Probably the reason why green vegetables are tolerated so well is because the starch is converted into levulose and not dextrose. The objection to saccharin and dulcein for sweetening is that they do not represent a food, but a foreign body in the organism.

In support of this assertion is the case cited by the author above, in which forced feeding with lettuce seemed to be at least a factor in causing the disappearance of the red reaction.

## DIABETES INSIPIDUS.

**Definition.**—A disease characterized by persistent polyuria, often excessive, without presence of sugar or albumin in the urine, and usually accompanied by polydipsia.

**Etiology.**—The disease is thought to be a neurosis, having its origin in the dilatation of the renal arteries from paralysis or irritation of their vaso-motor nerves.

The various exciting causes may be grouped as follows:

1. Trauma, inflammation, or irritation of the brain, cerebellum or medulla; sunstroke, cerebral tumors and syphilis, myelitis, violent mental emotions.
2. Heredity, occurring in families.
3. Tubercular meningitis, epilepsy, hereditary syphilis; as sequela of acute infectious diseases, and in scurvy; in saccharine diabetes after disappearance of sugar; as a result of excessive drinking; in young children from drinking alcoholic liquors.
4. Exposure to cold and drinking cold fluids when heated; abuse of diuretics. Inveterate masturbation, incontinence of urine, and tape-worm.
5. Abdominal tumors, especially near cœliac plexus, and chronic inflammatory processes in same region.

The etiology is probably unknown. *Clinically* we find it most commonly excited by emotional disturbance, concussion; or injury to the brain or body; syphilis, or previous acute disease as *typhoid fever*, malaria, cerebro-spinal meningitis, influenza or syphilis.

**Occurrence.**—Occurs in males more often than in females, more frequent in the first half of life, and may occur even in young children. In fifty per cent. of Roberts's seventy cases the patients were under twenty, and in ten per cent. infants. Only four cases out of the seventy were over fifty years of age.

In the writer's experience the disease is a rare one, occurring not half a dozen times in nearly 6,000 cases of all sorts examined.

Like diabetes mellitus it may attack members of the same family.

One-fifth of all the cases reported occur in children under ten years of age. It has been reported in a child as young as three or may apparently be congenital.

It may alternate in families with central neuroses, as hysteria, epilepsy, neurasthenia, psychopathy, and occasionally with diabetes mellitus.

It may be due to the toxic influence of digitalis or other diuretics, alcohol and lead.

Symptomatically it may be a result of diseases of the nervous system, as softening of the brain or new growths in the floor of the fourth ventricle near the glycosuric point.

It may be associated with neurasthenic symptoms, insomnia and chorea.

**Post-Mortem Appearances.**—Lesions of the brain and nervous system, as in the floor of the fourth ventricle, are found in some cases, and in the vicinity of the celiac plexus in others. The kidneys are enlarged, and in certain cases the pelvis and ureters dilated and the bladder hypertrophied.

It is held that the cases in which tumors or inflammatory

changes in the medulla or cerebellum are found, together with exostoses at the base of the brain, are those of symptomatic polyuria rather than true diabetes insipidus.

**Onset.**—It may begin immediately after drinking a large amount of fluid, as on a hot day after a long march, or as result of injury, or may begin gradually.

Cases are known in which the disease is congenital.

It usually begins with headache, vertigo, a feeling of malaise, irritability, disturbed sleep and alterations in the appetite.

**Clinical Features.**—These are essentially the following:

1. Polyuria, which may be excessive, one or two gallons, even, of urine being voided in 24 hours.

2. Excessive thirst, polydipsia.

These may be the only features in the mild cases. In severer cases we find:

3. Dry, harsh, hot, shrivelled and scaly skin; dry mouth and throat.

4. Headache, vertigo, mental symptoms, neuralgia.

5. Loss of strength and of flesh, weakness of the pulse.

In cases where the amount of solids voided is not in excess of normal, the patient feels poorly, is easily chilled, appetite is capricious, and there is a sinking, gnawing sensation in the pit of the stomach.

When cerebral lesions are present, disturbances of sensibility or of motion occur. Headache or convulsions may occur. Ptyalism has been noticed in several cases.

The amount of urine voided may exceed the amount of fluids ingested

Furunculosis is rare. Cataract is less common than in diabetes mellitus, as is also pulmonary tuberculosis. The appetite is not excessive. The bowels are regular or but slightly constipated and gastro-intestinal disturbances are not marked.

The sexual function is not disturbed. The temperature is normal or slightly subnormal, perhaps on account of the drinking of much cold water.

In severe cases the patient becomes emaciated, languid, feeble and loses inclination to exertion. The sleep is disturbed and the mind depressed. The patient is irritable and nervous.

The knee-jerks are enfeebled or absent.

Neuroretinitis and paralysis of the ocular muscles may be present.

The bodily temperature is low and the patient feels chilly.

Osler mentions tolerance of alcohol as a marked feature of diabetes insipidus; the patient may be able to drink two pints of brandy in a day or a dozen bottles of wine.

**The Urine.**—We find two forms of this disorder, namely, *hydruria* and *polyuria*. In hydruria the quantity of urine per twenty-four hours is enormous, and the specific gravity below 1008. In polyuria the quantity of urine, though not enormous, is greatly increased, and the specific gravity 1010 and upwards.

The total urine per twenty-four hours is usually that of fluids ingested; but if the fluids be cut off the urine is not diminished proportionately. The volume of urine per twenty-four hours is generally greater than that of diabetes mellitus. Very young children have been known to void as much as thirty pints in the twenty-four hours. Roberts speaks of a girl of ten who voided a little more than a third of her own weight of urine. Ten to fifteen pints daily (5000 to 7500 c.c.) is not uncommon in the case of children afflicted with this disease.

Boggess reports a case in which a colored girl of eleven drank from seven to nine gallons of water during the twenty-four hours and passed about the same amount of urine. The specific gravity of the urine was about the same as that of water.

The total solids are, as a rule, above normal per twenty-four hours, though decreased relatively (grains per ounce, grams per liter).

In some cases, without great increase in twenty-four hours' urine, the total phosphoric acid is double or treble the normal per twenty-four hours (phosphatic diabetes) and the urea-phosphoric acid ratio diminished.

Albumose, hippuric acid and inosite may occur in the urine.

*Physical Characteristics.*—We find feebly acid urine which readily decomposes and then deposits a creamy-white sediment of amorphous phosphates. Color and odor deficient. Appearance clear when voided, soon becoming cloudy from presence of micro-organisms. Sediment scanty, containing nothing of significance.

In case various intercurrent disorders appear, the urine may be considerably diminished in amount.

Cases are known in which excessive elimination of phosphoric acid occurs. In these cases, although sugar is absent, there is, in addition to the symptoms mentioned above, a tendency to boils, ravenous appetite, possibly cataract, as in the case of diabetes mellitus. This kind of diabetes insipidus is called phosphatic diabetes and is associated sometimes with nervous derangements or with phthisis, sometimes with neither. Again, in some cases excessive elimination of the chlorides may be noticed (chlorine diabetes).

**Diagnosis.**—The determining points are an excessive polyuria, polydipsia, and weakness, as in diabetes mellitus, but the polyuria averages greater and there is no sugar in the urine and the specific gravity is low. On depriving the patient of water, if the urine decreases in amount, the disease may be regarded as primarily polydipsia, but if not, polyuria.

**Course.**—Uncertain. Congenital cases may last fifty or sixty years. Recovery, when it takes place, is usually in one or two years from time of onset.

The disease may merge into diabetes mellitus. The course is usually chronic and long.

**Differential Diagnosis.**—The conditions which are to be differentiated are as follows :

1. Hysterical polyuria.
2. Chronic interstitial nephritis.
3. Hydronephrosis.
4. Convalescence from acute nephritis, especially post-scarlatinal, and from other acute diseases.
5. Neurasthenic polyuria.
6. Polyuria in women with pelvic congestion and constipation.
7. Diseases of the medulla and cerebrum with polyuria ; chronic hydrocephalus with polyuria.
8. Polyuria from use of diuretics as in dropsy and from absorption of serous effusions.

Diabetes insipidus is distinguished from the first by its persistence ; from the second by absence of cardio-vascular changes and of albuminuria and cylindruria ; from the third by persistence, and absence of tumor diminishing in size, with abundant flow of urine ; from the fourth by the history, absence of albuminuria and cylindruria, and presence of persistent excessive polyuria.

Neurasthenics may void considerable urine of low specific gravity, but a quantity over five pints is not usually a persistent symptom, nor is there usually the thirst found in diabetes insipidus.

Women who have pelvic congestion and are constipated void a good deal of urine, but not an enormous quantity ; moreover, the night urine is likely to exceed the day very considerably.

In general diabetes insipidus may be distinguished by the enormous flow of urine which is usually in excess of fluids ingested.

Eichhorst describes cases of diabetes insipidus occurring in connection with certain specific infectious diseases, such as diphtheria, cerebro-spinal meningitis, measles, scarlet fever, etc. These must be distinguished from the cases of transient polyuria described by Spitz, which occur during conva-

lescence after certain specific fevers, especially typhoid. In these last cases the polyuria lasts from six to eight weeks, and is not accompanied by polydipsia.

**Prognosis.**—Death is rare from the disease itself, which may last a lifetime. The danger is from other disorders, especially phthisis, pleuro-pneumonia, carcinoma, or organic disease of the brain. In syphilitic cases the prognosis depends on the curability of the syphilis.

Cases beginning suddenly may run an acute course and may die within a few months, though, doubtless, not of the disease itself, but of the lesion causing it.

The condition of the urine is to be considered ; if urea and phosphoric acid are not in great excess, the patient being well cared for and without hereditary taint, it is possible that he may live as long as otherwise. If, on the other hand, there is a marked increase of urea and phosphoric acid, suspect the condition to be but a prelude to serious constitutional disturbance, and give ultimately unfavorable prognosis. In some cases nervous disorder or phthisis appears ; in others, diabetes mellitus. Albumin in appreciable quantity is an unfavorable sign, as is also oedema of the feet. In one case which I saw, apparently congenital, at the age of sixteen, I found albumin in the urine ; two years later casts appeared, the patient became more or less oedematous, and died of uræmia.

It must be remembered, however, that a mere trace of albumin is quite often found in the urine of not only this disease, but of diabetes mellitus as well, perhaps due to irritation of the kidneys. It does not necessarily signify nephritis.

Children may succumb to exhaustion, caused by loss of rest, tormenting thirst, and mental worry.

Death often is the result of exhaustion, pulmonary disease or intercurrent affections. In general, the prognosis is usually unfavorable and recovery rare. In some cases the disease becomes stationary and the patient lives to be old in spite of it.

The hereditary congenital variety may not be serious.

Cases have been known where the disease was apparently congenital in different members of the same family, most of whom lived to old age.

Spontaneous cure may occur in some cases.

**Treatment.**—Everything which aggravates the condition must be sought for, and if possible removed ; inveterate masturbation, enuresis, tape-worm, and hereditary syphilis must not be overlooked. Phimosis and rectal diseases should receive attention.

When the patient is not voiding too much urea, give food and drink liberally, seeing to it that drinks are not too cold. The various drinks may be thickened, as, for example, by the use of a handful of raw oatmeal to a quart of boiling water, with a lemon sliced into it. Warm woollens should be worn, and the patient, if possible, spend winters in a warm, dry climate. Salt-water douches are sometimes useful in promoting bodily vigor. Warm baths, followed by friction of the skin with coarse towels, are beneficial.

In cases where urea is increased relatively to the weight of the patient, nitrogenous food is to be limited. Alcoholic drinks and coffee are not allowed. Vapor-baths, followed by salt-water tepid douches, are recommended and a dry, bracing climate sought. Hygienic care and regulations, as in diabetes mellitus, ordinary warm baths, followed by friction of the skin with coarse towels, are often found beneficial.

For the thirst, hot alkaline mineral waters, as Allouez, should be tried.

The amount of water taken should be gradually reduced and methodical physical exercise practiced.

**Symptomatic Treatment.**—*Strychnine phosphate*.—Useful for the various nervous symptoms, as weakness, depression of spirits, irritability, etc. Use the second decimal.

*Ferrum*.—In anæmic cases, indications already given. Use Ferrum phos. in the second decimal.

*Scilla*.—In cases where there is an inordinate quantity of pale urine.

*Apocynum*.—In cases where there is a marked sensation of sinking in the epigastric region.

*Helonias*.—Abnormal languor, feeling of weakness and weight in the region of the kidneys, general weariness ; the patient wakes in the morning with lips, tongue and fauces dry, and a bitter, disagreeable taste in the mouth ; pain and feeling of lameness in the whole back ; numbness in the feet relieved by motion ; chill ; gloomy and irritable mental condition ; profound melancholia.

*Secale* is indicated when great thirst predominates, and particularly when there is lack of contractile force in the tissues.

*Rhus aromatica* is useful when there is persistent enuresis.

*Thuja* may quickly relieve cases where there is frequent urination with heat and a burning desire to urinate again soon after the bladder is emptied. Given by Waterhouse in drop doses (Lloyd's tincture) in glycerine.

In cases depending upon incurable brain trouble we cannot expect relief from symptomatic or other treatment.

**Palliative Treatment.**—Those remedies already mentioned under diabetes mellitus are frequently indicated in this disorder.

In anaemia and debility, *cod-liver oil* and the *Iodide of Iron* will help debilitated children with diabetes insipidus. In syphilitic cases, *Iodide of Sodium* and mercurial inunctions.

*Jambul* will undoubtedly, in some cases, decrease the quantity of urine, but its action is at best but imperfectly understood, and it is said not to be efficacious with the patient on a mixed diet.

*Sodium bromide* is believed by Purdy to have arrested two cases ; he thinks that the drug should be given in doses large enough to affect locomotion, and then decreased to a point just short of affecting it. In some cases the constant galvanic current has been found beneficial. Purdy says that the best results are said to follow the application of the positive pole to the cervical region over the vertebra, and the negative pole to the lumbar region and pit of the stomach alternately.

*Ergot* appears to have cured some cases. The doses recommended are 60 to 120 minims of the fluid extract for an adult.

*Miscellaneous*.—Claims are made of cures by the following agents: *Potassium iodide* and *Mercury* (dose not given) reduced the urine of a child of six from thirty pints to four (Demme); combined use of *Antipyrin*, 0.5 gramme ( $7\frac{3}{4}$  grains) three times daily, powdered *Valerian root* three times daily, and galvanism to the cervical sympathetic and to the spine, cured a case in a boy of twelve years, who voided 13,700 c.c. in twenty-four hours, with specific gravity less than 1001 (Zeuner).

Extract of *Ergot* (ten grains in capsule three to six times daily), Zinc valerinate (one or two grains in capsule three or four times a day) are deemed effective.

It is held that the dose of these agents should be increased until some therapeutic or physiological effect is produced.

W. F. Clark claims success in diabetes insipidus from ingestion of suprarenal glands.

For the thirst and polyuria *Opium* is said to be helpful given in the form of laudanum; dose, fifteen to twenty drops, several times daily.

Anders thinks that *Ergot* is the best remedy, next the Bro-mides and Acetanilid given alternately at intervals of a couple of weeks.

Static electricity may be of assistance in reducing the quantity of urine.

In nervous polyuria in women static electricity is worth trying.

## CHAPTER XXI.

### CLINICAL MEMORANDA AND SUMMARY.

**The Mortality in Five Hundred Cases of Albuminuria.—**  
What is the significance of albuminuria? With view to obtain data by means of which this question may be answered, I have looked up the present condition of 800 persons in whose urine at one time or other I had found albumin, and 300 persons in whose urine I had never found albumin.

I have succeeded thus far in tracing 558 of the albuminurics and 253 of the non-albuminurics.

The statistics of mortality among them are as follows: From January 1, 1888, to January 1, 1895, 126 out of the 558 albuminurics have died, or about 23 per cent.; 28 out of the 253 non-albuminurics are dead, or about 11 per cent.

The percentage of mortality, then, among the albuminurics is more than double that among those in whose urine albumin was not found.

The test for albumin which I have used is Ultzmann's, viz., filtering, boiling upper third, add three to six drops of 20 per cent. acetic acid; more if the urine is alkaline, less if not.

Is the mortality among all classes of albuminurics the same? In answer to this question my statistics show the following: Albumin, *without* tube-casts of any kind (save possibly so-called mucous casts), occurred in the urine of 255 persons out of 558, and of these 255 only 37 are dead, a mortality of about 14 per cent.

In other words, the percentage of mortality among the albuminurics without tube-casts is only 3 per cent. greater than that of those in whose urine no albumin at all was found. Pus, blood, bile, prostatic and seminal fluids, leucorrhœal ad-

mixture, and twenty-four hours' urine, in which, from decomposing mucus, micro-organisms are numerous, are doubtless factors in the albumin reaction, where it is obtained without presence of casts.

So, then, the individual who says that his urine is "all right," because of absence of albumin and sugar, has not such overwhelming odds in his favor, over and above him in whose urine albumin alone, without casts, is found.

What is the mortality among those in whose urine both albumin and casts are found? There were 304 such persons in all out of the 558 albuminurics, whose present condition I know with certainty, and of the 304, 89 are dead, or about 30 per cent.

In other words, where casts are found, together with albumin, the mortality is nearly three times as great as in the non-albuminuric cases, and more than twice as great as in those who have albumin without casts.

#### SUMMARY NO. I 1888-1895.

I. Non-albuminuric cases whose present condition is known with certainty,	253
Deaths,	28
Percentage of mortality thus far,	11
II. Albuminurics without casts,	255
Deaths,	37
Mortality per cent; thus far,	14
III. Albuminurics with casts,	304
Deaths,	89
Percentage of mortality thus far, about	30

What influence, if any, has the kind of casts found on the mortality? Of the 304 albuminurics with casts of all sorts, 177 were those in which the casts were either hyaline or epithelial, at any rate not granular, waxy, or fatty. Of these 177 there are 36 dead, or 20 per cent. On the other hand, there were 127 persons in whose urine either granular, fatty, or waxy casts, or all three together, were found, and of these 127 there are 53 dead, a percentage of 41, the highest of all thus far recorded.

These figures would appear to show two things: First, that the occurrence of albumin, together with hyaline or epithelial casts, is not without significance. The mortality in such a condition is nearly twice as great as where neither albumin nor casts are found, and nearly once and a half as great as where albumin without casts occurs. [I recall that in several fatal cases albumin and hyaline or epithelial casts would be found for months or years, then suddenly granular casts would appear, perhaps not until within a few weeks or even days before death.]

Second, whatever may be the alleged clinical significance of granular casts, and whatever may be the pathological theories founded on post-mortem examination, actual statistics show the following as regards mortality from 1888 to the present time, (when this paper was written), 1895:

In 1888 I saw one such case, a woman, in whose urine at the time of menopause granular casts were found by me. She died in a few months.

In 1889, nine cases came under my observation. All were men, and four have since died. In other words, more than half were alive at the end of six years.

In 1890 there were twelve, eight men and four women. Seven have since died, or 60 per cent. Of the dead, four were men, and three were women. In other words, a little more than half died in a space of five years, and a little less than half were still living.

In 1891 I saw fourteen cases, thirteen men and one woman. Nine of them, all men, died, or 65 per cent., but one-third of the cases were still alive at the end of four years.

In 1892 the total was thirty, nineteen men and eleven women. Twelve died, namely, seven men and five women, making a mortality thus far of 40 per cent. In other words, more than half were still alive at the end of three years.

In 1893 I saw thirty-three cases, twenty men and thirteen women. Thirteen died, namely, seven men and six women.

The mortality thus far is 40 per cent. More than half them were alive at the end of two years.

In 1894 there were twenty-eight cases, twenty-four men and four women. Seven died up to January 1, 1895, namely, six men and one woman. The mortality thus far in these cases is 25 per cent.

According to sex the figures are as follows : Total number of men, 93 ; women, 34 ; mortality among men, 37, or 40 per cent.; of the women 16 died, or 47 per cent.

In how many of the fatal cases were the casts waxy or fatty, and in how many granular alone ?

Typical well-pronounced fatty casts in which fat droplets could be seen were found in ten of the fatal cases, waxy casts in six, casts which would ordinarily be called granular\* in 44.

Finally, then, the finding of granular casts in the urine is by no means significant of rapid dissolution, not even in chronic cases, most of the cases above being of the latter variety. Five patients with granular casts were alive at the end of six years, 5 at the end of five years, 5 at the end of four years, 18 at the end of three years, 20 at the end of two years, 21 at the end of a year. Nobody knows, of course, for how long any of these had granular casts in their urine, or at what times or under what circumstances.

Paying attention then solely to my figures and without regard to anything else whatever, if granular casts with albumen are found in the urine, the patient has three chances in four of living one year, and about one chance in two of living two to six years. In other words, about half the patients in whose urine I have found granular casts have died in periods ranging from two to six years.

It seems to me that this is a favorable showing when we consider of what dreadful portent the term "granular cast" has been in the past.

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\* The writer is aware that many casts apparently granular, when seen with a high power, are really fatty.

Care was taken in all these cases not to confound zoögloea masses of bacteria, deposits of urates or phosphates, or extraneous matters of any kind with casts, and in no case were the casts called granular unless unmistakably so. In several cases suspicious looking granular fragments or masses were encountered without the size, shape and appearance characteristic of true renal granular casts. Such cases have not been included in the category above.

## SUMMARY NO. 2.

Albuminurics with casts, . . . . .	304
I. Without granular, fatty or waxy casts, . . . . .	177
Deaths, . . . . .	36
Percentage of mortality thus far, . . . . .	20
—	—
II. With granular, fatty or waxy casts, . . . . .	127
Deaths, . . . . .	53
Percentage of mortality thus far, . . . . .	41
—	—
III. Mortality in those of II. according to sex.	
(a) Total number of men, . . . . .	93
Deaths, . . . . .	37
Percentage of mortality thus far, . . . . .	40
—	—
(b) Total number of women, . . . . .	34
Deaths, . . . . .	16
Percentage of mortality thus far, . . . . .	47
—	—

What bearing has urea on the mortality in cases of albuminuria, together with granular, fatty or waxy casts?

Urea was estimated at one time or other in the 24 hours' urine of 28 persons who died. The smallest amount of urea in 24 hours was 90 grains (6 grammes), the largest, 415 grains (27 grammes). The average total urea in these 28 fatal cases was 210 grains (14 grammes) in 24 hours. The average total urea in 210 other cases, without albumin, casts or sugar, was 350 grains (23 grammes). These 210 cases were picked up at random from my records and not selected with care. In other words, the average daily excretion of urea in the 28 fatal

cases of persons passing albumin and granular casts was nearly 150 grains (10 grammes) less than that of 210 persons in whose urine neither albumin, casts or sugar was to be found.

Taking 300 grains of urea (20 grammes) as a basis of consideration, 66 per cent. of the 210 persons just mentioned failed to void this quantity in 24 hours, whilst 85 per cent. of the 28 fatal cases did not excrete this quantity.

What relation did percentage quantity of albumin bear to the mortality in cases of albuminuria with granular casts?

Observation of the percentage quantity of albumin was made in 49 fatal cases: 21 passed enough albumin so that from the specimen furnished the coagulated mass rose to the first mark, 1, on the Esbach tube or higher, the highest being to the mark 7. In 12 cases there was enough albumin to be noticed in the Esbach tube, but it failed to rise as high as the figure 1. In 16 cases but a trace could be found with Ultzmann's test.

In other words, in less than half the fatal cases when observation of the quantity of albumin was taken, did the latter occur in quantity sufficient to attract the attention of the general practitioner, and in one-third of the cases the chances are that the presence of albumin would not have been detected at all, except by one more than ordinarily familiar with urine testing. [I base this last supposition on observation of the work of some 500 men to whom I have taught urinary analysis. It is only after a number of exercises that they can be depended on to detect what experts call a "plain trace" of albumin.]

What relation did specific gravity bear to these cases? The specific gravity of the twenty-four hours' urine was taken in forty-four of the fatal cases. It was 1,015, or less, in twenty-one cases, the lowest being 1,006. It was above 1,015 in twenty-three cases, above 1,020 in nine cases, above 1,030 in three cases. In other words, while it was below 1,020 in thirty-three out of forty-four fatal cases, or seventy-five per cent., it was above 1,015 in more than half the fatal cases.

What observations were made on the quantity of urine for twenty-four hours?

In twenty-eight fatal cases the twenty-four hours' urine was collected and measured. Above fifty fluidounces (1,500 c.c.) occurred eight times; between thirty-three and fifty fluidounces (1,000 to 1,500 c.c.) four times; between seventeen and thirty-three (500 to 1,000 c.c.) ten times; less than one pint (500 c.c.) five times. The smallest quantity observed was about one fluidounce (40 c.c.) in twenty-four hours. So then, twenty out of twenty-eight in the fatal cases passed less than three pints (1,500 c.c.) in twenty-four hours, and sixteen out of twenty-eight passed less than two pints (1,000 c.c.).

[This is in accord with my general observations on the urine of all diseases in Chicago and vicinity. Out of 1,300 persons of all sorts, eighty per cent. voided less than three pints of urine in twenty-four hours, and nearly fifty per cent. less than a pint.]

What relation did color of the urine bear to mortality?

I have already said\* that a peculiar color appearing in the urine has been observed in certain fatal cases; this color is best imitated by diluting the official solution of oxychloride of iron with water, usually about equal parts of each. This oxychloride color was observed in five cases of albuminuria with granular casts, all of which cases, I believe, were of cardiac lesion in the opinion of the attending physician, or, at any rate, those in which cardiac trouble was evident. I have noticed the oxychloride color twelve times in all, always in cases soon terminating fatally.

#### SUMMARY NO. 3.

Fatal cases of albuminuria, with also presence of granular, fatty or waxy casts.

I. Urea estimations in 28 fatal cases showed average 24 hours' quantity of urea to be 14 grammes (210 grains).

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\**Medical Current*, p. 11, 1895.

- II. Urea estimations in 210 other cases, non-albuminuric, without casts, and non-diabetic, showed average quantity of urea to be 23 grammes (350 grains).
- III. Percentage quantity of albumin in 49 fatal cases:
- |   |    |
|---|----|
| Up to or above the first mark, 1, on Esbach tube, . . . . .                               | 21 |
| Less than up to the mark, 1, on Esbach tube, . . . . .                                    | 12 |
| Quantity too small to be measured at all, but plain trace with Ultzmann's test, . . . . . | 16 |
- IV. Specific gravity in 44 fatal cases:
- |                          |           |
|--------------------------|-----------|
| 1,015 or less, . . . . . | 21 cases. |
| Above 1,015, . . . . .   | 23 cases. |
| Above 1,020, . . . . .   | 9 cases.  |
| Above 1,030, . . . . .   | 3 cases.  |
- V. Twenty-four hours' quantity of urine in 28 fatal cases:
- |                                       |           |
|---------------------------------------|-----------|
| Above 3 pints (1,500 c.c.), . . . . . | 8 cases.  |
| Below 3 pints (1,500 c.c.), . . . . . | 20 cases. |
| Below 2 pints (1,000 c.c.), . . . . . | 17 cases. |
| Below 1 pint (500 c.c.), . . . . .    | 5 cases.  |
- VI. Color and appearance in 5 fatal cases was observed to be that imitated by diluting oxychloride of iron solution with equal parts of water.

#### MISCELLANEOUS QUESTIONS ON THE CASES OF ALBUMINURIA WITH GRANULAR, FATTY OR WAXY CASTS.

1. Was urea *always* much diminished when albumin and casts were abundant?

*Answer.*—No. In case No. 81, in which the most albumin of any was found, *e.g.*, up to the seventh mark on the Esbach tube, and in which numerous casts of various kinds, granular, fatty and waxy, were found, three hundred grains of urea (nearly 20 grammes) were voided in forty-two ounces (1,260 c.c.) of urine. The patient died of suffocation from dropsy, without at any time showing uræmic symptoms. The analysis above mentioned was made a few weeks before death.

2. Was urea *usually* decreased, either in grains per ounce or grains per twenty-four hours, in those cases in which percentage of albumin was high?

*Answer.*—Yes, in fourteen out of eighteen such cases.

3. Was urea *ever* excessive in quantity in any of these cases with high percentage of albumin?

*Answer.*—Never in total quantity per twenty-four hours. In grains per ounce (grammes per liter) it was from normal to excessive several times—three times I found it seven or eight grains per fluid ounce (15-17 grammes per liter); once twelve grains per ounce (25 grammes per liter); once sixteen grains per ounce (34 grammes per liter) a few days before death. I have seen it eight to twelve grains per ounce (17-25 grammes per liter) twenty-four hours before death. In Case 79 a woman who passed but one fluidounce of urine in twenty-four hours (40 c.c.), I found the urea twenty-three grains per fluidounce (49 grammes per liter). She died a few days afterwards.

4. How low relatively, that is, in grains per ounce, was urea observed in cases where there was high percentage of albumin?

*Answer.*—In eighteen cases in which the percentage of albumin was high, urea occurred as low as one grain per fluidounce (2 grammes per liter) once; two to two and a half grains per ounce several times; four or five grains per ounce several times.

5. In how many of the fatal cases was œdema or dropsy observed?

*Answer.*—In fourteen.

6. In how many dyspnœa?

*Answer.*—In eight, so far as I know.

7. In how many were cardiac lesions plainly evident?

*Answer.*—In nine; hypertrophy, four; dilatation, three; valvular diseases, three; all three, one.

8. In how many nausea or vomiting?

*Answer.*—Five.

9. In how many retinal troubles?

*Answer.*—Four.

10. Were there any cases in which no symptoms were noticed other than the condition of the urine?

*Answer.* Yes, several. Case 52, an elderly man was pro-

nounced, ten days before death, to be without organic disease of any kind by one of the best experts in physical diagnosis whom I know of in the United States. The urine, however, told the story: Albumin plainly present in small quantity, hyaline casts for a week or two, followed by sudden apparition of numerous granular casts, and then death from uræmia in three or four days.

Case 28 was an old gentleman without any symptoms at all which I can recall or have record of. I made several examinations of the twenty-four hours' urine. It averaged thirty-two fluidounces (960 c.c.); night urine exceeded day, specific gravity was 1,018, urea 200 grains (13 grammes) in twenty-four hours. Trace of albumin and a few granular and fatty casts. He died suddenly, when apparently better than when I saw him last.

Case 33 was another elderly man, whose only symptom was nausea. This grew worse and worse until finally he could retain nothing on his stomach. His urine then was as follows: Thirty fluid ounces (900 c.c.) in twenty-four hours, night volume equal to that of day; specific gravity 1,012, albumin about one-sixtieth, urea 170 grains (11 grammes) per twenty-four hours, dark granular casts in sediment. Death in a week.

11. What are apparently the most unfavorable signs shown by the urine?

*Answers.*—(1) The oxychloride color thus far an invariably fatal sign; no recoveries. (2) The long, dark, straight, granular casts; recovery in only one case thus far noted, and that not yet assured, in a boy of ten. (3) The granular casts, which, with a low power, seem to be of a *mouse color*, but with higher powers are seen to be fatty. I cannot give exact figures in regard to these last, but do not recall any recoveries at present, and can remember several deaths. (Reprinted from the writer's paper in the *N. Y. Med. Times*, 1895.)

## DIAGNOSTIC SUMMARY OF URINARY DISEASES.

The following summary may be found useful for diagnostic purposes :

**Movable Kidney.**—The patient is commonly a woman, either a young woman of chlorotic type or a thin woman between twenty and forty, who has borne several children, perhaps in rapid succession. She may have a bewildering complexus of symptoms, mental, neurasthenic, gastro-intestinal, hepatic, uterine, ovarian, as well as renal. She suffers from renal pain, which may be either a dull, aching, dragging pain in the side, with severe attacks like renal colic (Dietl's crises), or be chronic like a neuralgia, with severe exacerbations. She has a movable tumor in the loin, manipulation of which may cause peculiar sinking, fainting sensation, or nausea. She may have frequency of urination and vesical tenesmus, but the urine may not show abnormal features except when blood is present or nephritis or tuberculosis co-exist. At times the urine is scanty and high-colored, or may be suppressed for a short time, following which the patient will pass urine abundantly for a short period.

**Renal Embolism.**—The patient has usually a history of endocarditis, suddenly feels a pain in the region of the kidneys, and has repeated chills and various cardiac symptoms; the renal pain may be severe enough to cause vomiting and collapse. The urine becomes suddenly albuminous, but the albumin disappears in from two to four weeks; tube-casts are found (hyaline, epithelial and leukocyte) for a few days, but soon disappear. Evidences of the disease may pass away in a few weeks.

**Active Renal Hyperæmia.**—The patient has a history of a surgical operation on the urinary tract, or of exposure to cold, or of some acute inflammatory disease. The condition is also present in cases of poisoning, as by Cantharides and Turpen-

tine. There is frequency of urination, urgency and possibly straining, but the urine is scanty, there is pain in the back, sometimes headache, nausea and vomiting. If the condition is not relieved, the patient may show alarming symptoms—delirium, coma or convulsions. The urine is decreased or suppressed; does not always contain albumin or casts, but quite commonly a sediment of urates associated with high color and high specific gravity, and sometimes more or less blood. Mild cases are found in many patients suffering from la grippe. The course is usually short and the termination favorable with proper management, but fatal cases after surgical operations or even the passage of a sound occasionally occur.

**Passive Renal Hyperæmia.**—The patient has a history of some obstruction to the circulation, commonly valvular disease of the heart. He complains of difficulty of breathing, especially on exertion, becomes œdematosus first about the feet or ankles, finally generally dropsical, but not usually about the face. Percussion sometimes shows presence of hydrothorax, usually most noticeable on the right side. The pulse is weak and rapid, and the patient may have a hacking cough. The urine is diminished in quantity sometimes to even less than ten fluidounces per twenty-four hours, is of high specific gravity, 1025 or upward, of deep red color and often cloudy from urates. The urine contains a small or moderate quantity of albumin and a few casts, seldom fatty or waxy. The course of the disease is usually slow and depends on the relief which can be given to the heart.

**Acute Nephritis.**—The patient is a child or young person with history of recent acute infectious disease, or a person with septic or toxic history, or that of exposure to cold and wet; sometimes a child with recent history of gastro-intestinal disorder only, such as vomiting or pain in the stomach and bowels. His face is œdematosus, especially above the eyes, and he becomes more or less generally dropsical; he is pallid,

weak, drowsy, and may have convulsions. The urine either gradually or suddenly diminishes in quantity, is "smoky" in hue from the presence of blood, abundantly albuminous and contains numerous casts, at first hyaline, epithelial and blood, later granular, later fatty and waxy. The urine may decrease to less than ten ounces per twenty-four hours, or become entirely suppressed. Cases without history of infectious diseases may show less blood or but little blood in the urine. The disease lasts about four weeks and two out of three recover in post-scarlatinal cases.

In other cases the prognosis is usually more favorable.

**Acute Nephritis of Pregnancy.**—The patient is a woman who has been pregnant three months or more and is most likely a primipara, or one with history of convulsions during previous gestation or of neurotic family history. Her general condition may be unimpaired for weeks or months, but in the later months of gestation she is dropsical not only about the feet, but also in the face and elsewhere; she loses her appetite and has nausea and vomiting any time during the day; her pulse is that of high tension, slow, full, and incompressible; she has headache, which may be severe, visual disturbances (dimness or haziness of vision or complete loss of sight) and epigastric distress, at times severe burning pain. The urine gradually diminishes in quantity, but is liable any time to a sudden decrease in quantity and to a considerable increase in urea in grains per fluidounce (12 to 17), at which time it becomes highly albuminous, but contains very few casts and seldom blood. Soon following the sudden decrease in urine she may have convulsions and, if the convulsive seizures are repeated several times, she becomes comatose and dies, or she may die during the convulsions. In some cases there are practically no noteworthy symptoms other than malaise and slight headache, until the sudden decrease in the quantity of urine and the presence of a large amount of albumin in it ushers in convulsions. If recovery is to take

place the symptoms subside after delivery. Convulsions occurring after delivery are usually an unfavorable sign. Patients who recover may have a small amount of albumin in the urine for years afterward before it finally disappears.

**Chronic Diffuse Nephritis Without Induration—(Large white or mottled kidney).**—The patient is usually between twenty and forty years of age, with a history of either anaemia, alcoholism or severe privations; it occurs, however, in young women, children and others without known cause, unless it be due to anaemia. The clinical features are pallor, puffiness under the eyes, doughy face, difficulty of breathing, anorexia and vomiting (especially in the early morning), weakness and dropsy. Severe digestive disturbances are not invariably present. The urine varies in quantity, but is not high in specific gravity nor usually high in color. The night urine equals or exceeds the day urine in quantity. A large amount of albumin is present, and numerous large casts, hyaline, granular, fatty and waxy. The sediment is likely to be whitish in color with, perhaps, reddish uric acid crystals and microscopically contains a large number of different objects.

The patient, if likely to recover, will do so in about a year. The longer the disease lasts the less likely is recovery.

**Treatment.**—Milk diet for at least three weeks, and non-nitrogenous diet subsequently, together with Apocynum, Ferrum and Arsenicum, are the chief reliance in treatment.

**Secondary Chronic Interstitial Nephritis.**—The patient has a history of large mottled or large white kidney persisting for a year or more, until circulatory and cardiac symptoms are prominent (increase of pulse tension, accentuation of the second sound of the heart, hypertrophy and eventually dilatation of the heart). He has dyspnoea of an asthmatic character from urænia, and pulmonary oedema or hydrothorax. Before cardiac dilatation he voids urine more abundantly than ever, pale in color, of low specific gravity, deficient in urea, but containing an abundance of albumin and numerous casts, in-

cluding waxy. Uræmic symptoms are present. He may have headache, dysentery, delirium, coma, convulsions or paralysis. He dies from collapse of the heart, secondary inflammations, general œdema with exhaustion, or uræmia as above. The patient may live several years, but will, in all probability, succumb eventually.

For treatment see general subject in preceding pages.

**Primary Chronic Interstitial Nephritis (Contracting Kidney).**—Diagnostic hint.—The disease is an obscure one. As a rule, albuminuria coinciding with headache, dyspepsia and a tense pulse signifies contracting kidney. There are, however, several kinds of cases :

1. **Mild, Slow Cases.**—The patient is a man over forty years of age, with a history of previous good health, prosperity, sedentary habits, and addiction to hearty eating. He is unaware that anything is the matter with him until he is either rejected for life insurance or happens to notice that he is rising more frequently at night to urinate than in former years. Physical examination may discover slight accentuation of the second sound of the heart, arterio-sclerosis or myocarditis, but the patient may not show well-marked evidences of cardiac disease at first, and may be mentally and physically active without ill results. He voids, however, pale urine copiously during the night, and the day urine, which is seldom of normal specific gravity, contains at least a trace of albumin and a few hyaline casts. The total quantity of phosphoric acid is usually subnormal. The patient may continue about his duties for years without showing marked symptoms of any kind, except more or less muscular weakness, but is liable to sudden death from acute uræmia, as the case becomes more pronounced, which it may do suddenly after years of quiescence.

2. **Typical Cases of more or less severity.**—The patient has a history as above, but in addition may be gouty, or of gouty or apoplectic ancestry, or have a history of stricture or ob-

struction to the free flow of urine. He complains of weakness, headache, digestive disturbances, intractable rheumatic pains and persistent neuralgia, especially post-cervical. (He may not, however, manifest all these symptoms in earlier stages, but is likely to suffer from at least two or more of them.) He will show, moreover, some of the following evidences sooner or later: Vertigo, insomnia, shortness of breath and asthmatic attacks, angina, haemorrhages (nasal, cerebral, retinal or cutaneous), transitory blindness, ringing or throbbing in the ears, mental disturbance; or peculiar temperature variations with weakness, pallor, loss of weight and night-sweats. He voids, as a rule, more urine than normal, of lessened specific gravity, containing, in the daytime or after exercise, at least a trace of albumin or a few casts. The night urine is pale and may contain neither albumin nor casts.

Physical examination may show arterio-sclerosis, which may be marked in the temporals, and accentuation of the second sound of the heart; also sometimes a slow, hard, cord-like radial pulse, and displacement of the apex-beat.

3. Cases with Severe Exacerbations.—The patient, originally with or without marked evidences of the disease, may be seized with an agonizing headache, followed by convulsions and coma, with highly albuminous urine. If he recover, albumin in the urine may diminish to a trace. Retinitis, apoplexy, paralysis, delirium or insanity may become features of his case. He may have convulsions, recover, and apparently be doing well, but suddenly grow weak and die of exhaustion. Or he may have dropsy for a time and recover from it in great part, but succumb to later attacks.

4. Cases in the Stage of Cardiac Dilatation.—The patient is elderly and has a history of contracting kidney of many years' standing, or perhaps of enlarged prostate. He has extreme difficulty of breathing, is dropsical and feeble; his pulse is weak and rapid; there are pulsations in the jugulars; he has a dilated heart and cirrhosis of the liver. There is a

strong odor of the urine in his breath and to his body, and his perspiration is sticky and urinous. His face is sunken and his features drawn and haggard. He is at first wakeful and anxious, but later becomes semi-delirious, drowsy and finally comatose.

**Amyloid Kidney.**—The patient may be either a child, or is more commonly between twenty and fifty years of age. He is sometimes of tuberculous ancestry, and has a history of syphilis, chronic suppuration, malignant growth, or some obscure cachexia. He is likely to be pale, sallow, cachectic, of muddy complexion, with brown rings round the eyelids, and manifests gastro-intestinal symptoms often in the form of an obstinate diarrhoea. He may have an enlarged liver and spleen, and he becomes dropsical and weak. He voids exceedingly clear urine, which is abundant in quantity and usually highly albuminous. The sediment is very scanty, but shows large, broad, hyaline and waxy casts, occasionally also granular and fatty. The disease is said to be the result of the long-continued action of toxins produced by the staphylococcus aureus, and recovery is unlikely.

**Cystic Kidney.**—The patient is usually between forty and fifty-five years of age, with history and symptoms of contracting kidney, together with obstinate haematuria and a bilateral, soft, non-fluctuant, kidney-shaped renal tumor, which, in the later stages, bulges out the abdomen sufficiently to be recognized by inspection. The urine is that of contracting kidney, together with blood (which, in later stages, is enormous in quantity), large granular casts, and finally triple-phosphate crystals due to accompanying cystitis. The patient may live a number of years, but eventually dies of uræmia or exhaustion from severe haemorrhages.

**Paranephric Abscess.**—Diagnostic hint:—A painful tumor in the region of the kidneys, together with fever, points to paranephric abscess.

The patient is most likely an adult male, with history of a

wound, surgical operation, or some suppurative lesion ; if a woman, she has probably had pelvic cellulitis. In either sex it may follow appendicular abscess.

The patient has fever and the various disturbances of the febrile state, pain in the region of the kidneys, worse on pressure and on movement, and finally a swelling occupying the lumbar region and sufficiently large to cause bulging, while the skin over it is congested and oedematous. The urine may not be noticeably abnormal unless the abscess ruptures into the urinary tract, when large quantities of pus and free fat will suddenly appear.

The course may be rapid, and, unless the pus can be evacuated, death may take place from septicæmia or other means. Early surgical treatment, with drainage in primary and recent cases, may effect a cure. Cases secondary to grave lesions of the kidneys or neighboring organs are usually fatal, and especially when the disease follows the puerperal state in septic conditions.

**Acute Suppurative Nephritis (Renal Abscess).**—Diagnostic hint:—Pus in the urine with grave constitutional disturbance suggests suppurative nephritis.

The patient is usually an elderly male, with a history of enlarged prostate and cystitis, less commonly either male or female, who, at any age, has a history of injury of the kidney, surgical operation on the lower urinary tract, urethral stricture, or embolism (as from malignant endocarditis), or pregnancy. He has chills, fever, sweat and sometimes pains in the region of the kidneys, together with various nervous, digestive and circulatory symptoms, as in fevers. His face is at first flushed, later sallow or jaundiced ; the expression is anxious ; the mouth dry and the tongue coated, often brown, fissured and crusted ; the pulse is rapid and feeble. He soon becomes drowsy, more or less delirious, goes into profound coma and then dies, usually in a few days after the onset of the disease.

The urine is usually alkaline, offensive, contains pus and abundance of albumin, triple-phosphate crystals and swarms of micro-organisms. Casts may be absent; if present, they are dark granular or composed of cocci. Micturition is frequent, but the quantity voided is small.

Treatment.—The diet is to be sustaining and to include stimulants. The treatment to disinfect the urinary tract, Urotropin or Helmitol being the principal drugs:

**Suppurative Nephritis (Chronic Cases).**—Diagnostic hint:—Progressive loss of flesh and strength in cases not tuberculous, accompanied by pyuria, suggests chronic suppurative nephritis.

There is loss of flesh and strength, with nervous, digestive and circulatory symptoms irregularly, and in less degree than in the more acute cases. The urine is like that of contracting kidney, together with pyuria. The patient may suffer for months or possibly a year or two, or the kidney originally affected may undergo atrophy, and recovery for the time take place.

**Pyelitis.**—Diagnostic hint:—Pus, without casts, in acid urine, without the clinical features of cystitis or urethritis, points to pyelitis.

The patient has most commonly a history of renal calculus, tuberculosis, gonorrhœa, or other infection of the lower urinary tract, as from use of unclean instruments, or failure to avoid sepsis after operations. In general, he has a history of irritation of the pelvis of the kidney from bacterial or toxic causes, presence of a foreign body, or rupture of a neighboring abscess.

In women there may be history of pregnancy or recent delivery. The patient may present (a) few evidences of any trouble and few or no constitutional symptoms, or complain of (b) dull pain in the region of one or both kidneys, with sensitiveness on pressure over one or the other kidney, or possibly both kidneys. During attacks of pain he may have

fever at night. The urine may be acid in reaction, if the case is uncomplicated with cystitis. In such cases it contains merely pus and a little albumin, usually less than ten per cent. bulk measurement by centrifugal sedimentation. The urine varies in character according to cause and complications. (See "Renal Calculus" and "Tuberculosis").

In long-standing cases of chronic pyelitis there is polyuria and light greenish urine, acid when voided, but soon turning alkaline. The microscope shows incomplete crystals of triple-phosphate in the freshly-voided urine. There is frequent but painless micturition.

The course of the disease depends upon the cause; after infectious diseases recovery usually takes place, and also when due to calculus in an operable case, after calculus is removed. Otherwise the case is a serious one and recovery unlikely, though the patient may live some years.

**Renal Calculus.**—Diagnostic hint:—Blood in the urine, more abundant after exercise, together with pain in the loin, points to renal calculus.

The patient is commonly a child or a middle-aged adult of sedentary or luxurious habits, with a history of residence in a limestone district, especially where artesian well-water is drunk, and often with recent history of a violent sudden exertion, jolt or fall. He is usually in good general condition and free from constitutional symptoms, but complains of more or less constant dull pain in the loin, especially when riding over a rough road, and may flinch when pressure is applied to the region of one or the other kidney, but cases occur in which no sensitiveness to pressure exists. Before renal colic occurs, the diagnosis may be verified by the X-ray apparatus.

Sooner or later he may suffer from an acute attack of pain (renal colic), especially after violent sudden exertion, jolt or fall, though it may occur in the night, waking the patient from sleep. Renal colic begins suddenly, is cutting, stabbing, sharply-defined, follows the course of the ureter toward the

genitals or into the thigh. The patient is in agony, lies usually on affected side with updrawn knees; the testicle on the affected side is frequently retracted; there may be chills or chilliness, faintness, nausea and vomiting. The pain may be most severe in the back or radiate upward into the epigastrium. After an hour or so it may cease as suddenly as it came on, or recurrent paroxysms may last for hours. The urine voided before renal colic may be almost normal during the night, but in the daytime or after exercise will contain either blood, pus, or both, and sometimes crystals, especially sharp-pointed crystals of uric acid. Cases have occurred in which the writer has never found crystals, but either blood or pus were present in the day urine, and sometimes also in the night.

Hyaline, epithelial, and yellow granular casts are usually found in the day urine in cases where they are not hidden by blood or pus. During renal colic micturition is frequent, but the urine is scanty or may be suppressed. The ratio of urea to uric acid may be low, below thirty to one. The amount of albumin is slight, corresponding to the blood and pus present. The reaction of the urine is usually acid, except in cases of phosphatic calculi, when it is alkaline.

**Hydronephrosis.**—Diagnostic hint:—A tumor in the loin, whose size varies with the amount of urine, points to hydronephrosis or pyonephrosis.

The patient has a history of long-continued obstruction to the free flow of urine, as from stricture of the urethra, enlarged prostate, twists, or spasmodic contraction of the ureters; tumors, calculi, displacements of the uterus and movable kidney are common causes. The patient may present (a) no symptoms which are characteristic, especially in the case of women; or may have (b) constant dull pain in the loin over the affected kidney, with gradual development of eventually large tumor, unilateral or bilateral, filling the greater part of abdomen, and finally the symptoms of pyonephrosis and sup-

purative nephritis or contracting kidney and chronic uræmia, or (c) intermittent cases may occur in which the tumor increases in size as the urine diminishes in quantity, and the patient has vomiting and fever for a few days, followed by polyuria, possibly haematuria, diminution in the volume of the tumor, and relief. The urine may be (a) almost normal, or (b) present the features of the disease causing the hydronephrosis, as renal calculus or enlarged prostate, or (c), in late stages, the features of contracting kidney. The fluid aspirated from the tumor is neutral or acid in reaction, never alkaline when fresh.

**Pyonephrosis.**—The patient has a history like that of hydronephrosis and of pyelitis. Commonly he has stone impacted in the pelvis of the kidney. The tumor is not so large as in hydronephrosis, and aspiration shows pus. The patient has the symptoms of pyelitis and the urine the features of this disease, especially those of calculous pyelitis, increasing as the tumor diminishes in size. Large amounts of free fat are sometimes found in the urine.

**Renal Tuberculosis.**—Diagnostic hint:—Haematuria at night in a person under forty, with pyrexia more or less marked, points to renal tuberculosis, especially if vesical symptoms are absent.

The patient is usually a male from twenty to thirty years of age, light in weight, often puny, anaemic, pale, with cold hands and clubbed finger-nails. He has a family history of cancer and tuberculosis, and may have suffered from repeated renal congestions. The finger in the rectum may discover nodules in the prostate and seminal vesicles. He has increased frequency of urination, both during the day and the night, and may pass blood during the night. The urine may first contain a little albumin only, later blood, pus and tubercular debris, with few or no tube-casts. Pain, painful urination, swelling in the loin and the general symptoms of chronic tuberculosis are finally present. Renal calculus may form in the course of the disease. .

**Malignant Renal Tumors.**—Diagnostic hint:—Unaccountable, persistent, violent pain in the region of the kidneys, together with progressive cachexia, should suggest the presence of malignant disease.

If the tumor is primary, the patient is more commonly a male in early or late adult life; occasionally an infant. If secondary, he has a history of primary malignant disease of the testicles or in the vicinity of the kidneys, especially of the right kidney. He has pain, not affected by movement, a feeling of pressure, becomes emaciated and cachectic, passes bloody urine and shows evidences of an immovable tumor in the lumbar region, the shape of the kidney, on one or both sides. As a result of the pressure of the tumor he may have œdema or ascites, or vomiting, constipation, anorexia, and icterus, or extreme pain in the chest, back, hip, thigh, testicles and leg. The urine, sooner or later, contains blood, which is usually small in amount at first, bears no relation to movement, and eventually becomes large in amount. Large shreds of connective tissue may be found by centrifugal sedimentation of the urine well shaken and diluted with four or five times its volume of water. Pus and débris are not conspicuous features. Nephritic complications cause presence of casts, uric acid crystals and more albumin than the blood accounts for.

**Ureteritis.**—Diagnostic hint:—An urgent desire to urinate followed by cramping pain ascending to the kidney suggests spasm of the ureter.

The patient has a history of pyelitis, cystitis, urethritis, or other disease of the lower urinary tract, and is quite commonly a woman. She presents either (a) the features of pyelitis, or has (b) pain along the course of the ureters, and shows evidences of tenderness when pressure is made on the vesical end of the ureter by means of the finger in the vagina. She may wake in the night with a pressing desire to urinate; urination is accompanied by more or less pain and spasm, and

may be followed by a cramping pain ascending to the kidney. The patient sleeps on the affected side and may have the habit of drawing the opposite thigh up over its fellow against the abdomen. She is unable to endure sexual intercourse, and after an attack of pain is excited and hysterical. Injection of warm water into the bladder causes an irresistible desire to urinate, which, if not promptly attended to, is followed by the cramping pain (renal tenesmus). In severe cases pressure or injection as above may bring on the spasm, and surgical intervention may be a necessity. The urine may show the features of pyelitis.

**Cystitis.** — Diagnostic hint :—Cloudy urine voided frequently, with pain and straining, points to cystitis.

The patient is either a young man who has had gonorrhœa, a middle-aged or old man with stone in the bladder, an elderly man with enlarged prostate and retention of urine, or a woman with vaginal, urethral or rectal disease, or who has recently borne a child. Cystitis from diseases of the spinal cord, resulting in retention, is also common, especially in locomotor ataxia. The patient has more or less pain in the bladder, frequency of urination, more or less straining after urinating, more or less difficulty in urinating, and, after a time, back-ache in the sacral region, leg-ache, headache and irregular movements of the bowels. The facial expression is one of weariness and depression, and in severe cases the features, after a time, are haggard and drawn. The digestion becomes impaired and there is more or less loss of flesh and strength. In acute cases there is slight febrile disturbance, considerable pain and tenesmus. The patient voids cloudy urine of acid reaction containing flocculent pus, blood-corpuscles and innumerable bacteria. In chronic cases the patient suffers less from pain and straining, and voids cloudy, offensive, alkaline urine, with sticky pus and triple phosphate. In acute cases albumin is sometimes quite abundant; in chronic cases merely a trace. The patient may recover from an acute at-

tack in from a week or two to a month, according to circumstances. Chronic cases may continue indefinitely, and terminate in suppurative nephritis and death, unless the cause can be relieved by surgical measures. Cystitis is essentially a secondary disorder.

**Abscess of the Bladder.**—The patient has the history and features of cystitis, but also localized induration, pain and tenderness shown by finger in the rectum. Sloughs of mucous membrane may plug the urethra.

**Prevesical Inflammation.**—This condition is shown by a sharply-defined, usually symmetrical tumor, just above the symphysis, sometimes terminating in suppuration.

**Stone in the Bladder.**—Diagnostic hint:—Frequency of urination, with pain and sudden stoppage of the stream, points to vesical calculus.

The patient is more commonly a male, who lives in a limestone district, and especially one who from any cause has residual urine, or who has had renal colic, but children may have uric acid calculi without residual urine. Female children may occasionally develop stone in the bladder as a result of the introduction of foreign bodies into the bladder from without, as, for example, hair-pins. The patient, if a male child, habitually pulls at the prepuce, or, if an adult, squeezes and rubs the under surface of the glans. He is likely to lie upon his back with hips raised to relieve the pain, which is felt along the urethra, at the end of the penis, in the testicles, or down the thighs. When urinating, which is done frequently, he feels the pain, and a sudden stoppage of the stream may occur, with a twinge of sharp pain shooting to the meatus. The urine presents the features of a gradually increasing cystitis, with deposit of blood and large numbers of crystals. In severe cases the urine is very foul and the pus is mixed with blood. The patient is worse when on his feet, and can ride with more ease than he can walk.

**Tuberculosis of the Bladder.**—Diagnostic hint:—Symptoms

like those of vesical calculus in a tuberculous patient should suggest vesical tuberculosis.

The patient is usually between fifteen and twenty-five years of age, with family history of tuberculosis or cancer, and personal history of masturbation with increasing frequency of urination. Cases of renal tuberculosis may develop tuberculosis of the bladder, in which the features are much the same as those of vesical stone, but the stoppage of the stream relieves the pain, which is in the middle of the penis and does not pass forward into the glans. The bladder is contracted and unable to hold more than five or six ounces; the pain ceases when half of this is voided; the day and night frequency is about the same, or the night frequency may rapidly increase. Bacteriological examination of the sediment may show the presence of *Bacillus tuberculosis*.

A frequent course pursued by tuberculosis is—first, development in one kidney; second, in the bladder; third, in the other kidney. The bladder may be infected, however, from the seminal vesicles or prostate.

**Tumors of the Bladder.**—Diagnostic hint:—Intermittent haematuria and pain in the bladder should suggest presence of a vesical tumor.

The patient is more commonly a middle-aged male, especially in cases other than myxoma, which occurs more often in children.

1. **Benign Growths.**—The patient first has haematuria, then pain and frequency, then relief of the pain after an attack of bleeding. He is likely to pass blood during the night, and his pain bears no relation to exercise. Haematuria is intermittent, with progressively increasing frequency.

2. **Malignant Growths.**—The patient has pain and frequency before voiding blood; he may cease to void blood, but yet suffer from pain and frequency. The writer has noticed in cancer of the bladder as much as twenty per cent. by bulk of albumin in urine free from blood (macroscopically) and without casts, but containing pus in moderate amount.

The urine contains blood and large shreds of connective tissue. Enormous clots of blood may be passed, with great pain and straining, and so organized as to resist handling without disintegration. In malignant tumors large numbers of epithelia of a great variety of shapes, with large nuclei, are seen. In malignant cases the finger in the rectum shows an area of induration in the bladder, and a sense of increased resistance when the bladder is empty; the patient is over fifty years of age, and pain is a marked feature.

In benign cases the patient may appear to recover after a haemorrhage, and attend to his duties as if he were nearly or quite well, but the tumor, if not removed, may in time press on the ureters, cause hydro- or pyonephrosis, and death from contracting kidney. The average duration of bladder growths unremoved is from three to seven years before death.

**Acute Prostatitis.**—Diagnostic hint:—Feeling on the part of the patient of something protruding into the rectum, with constant painful urination, should suggest acute prostatitis.

The patient is a man who has had gonorrhœa, especially if followed by stricture, or who has been addicted to sexual excess. Less commonly the disease is due to irritation of the prostate from various other causes, as passage of instruments, use of strong injections, etc.

He has a feeling of heat, weight and throbbing in the perineum, a constant desire to urinate without sense of relief, and great pain as the last few drops pass; the prostate being greatly enlarged, even to the size of a small orange, he has a feeling of something protruding into his rectum, and makes ineffectual attempts at stool; his mind is greatly disturbed and he may become slightly delirious or maniacal. There may be a slight febrile disturbance also. The finger in the rectum feels the enlarged prostate, which is exquisitely sensitive, and the touch of the finger excites immediate desire to urinate. After four to twelve days, if the temperature does not exceed 101° F. at any time, and chills, sweat and prostra-

tion are absent, resolution takes place and the patient recovers in about three weeks. Recovery is sometimes delayed until a stricture causing the disorder can be treated surgically.

**Prostatic Abscess.**—The patient has a history of acute prostatitis, with marked chills, high fever and considerable diminution of perineal pain and tension, the pain being lancinating in character, but less tense. Bursting of the abscess causes all pain and discomfort to vanish, but, as a rule, surgical intervention is necessary for relief.

**Chronic Prostatitis.**—Diagnostic hint:—A history of acute prostatitis, followed by symptoms like those of vesical calculus, should suggest chronic prostatitis.

The patient has usually a history of acute prostatitis, following which the prostate remains slightly enlarged. If he has a slight muco-purulent oozing from the meatus and this history as above, the diagnosis is not difficult, but otherwise the features resemble stone in the bladder, and sounding may be necessary. The patient usually has great mental depression, and an increase of pain on crossing the legs and in changing from sitting to standing, etc. The course is slow.

**Tuberculosis of the Prostate.**—The patient is tubercular or debilitated, and grows very slowly, but steadily, worse. He has slight haemorrhages from the urethra without relief. The finger in the rectum feels a lumpy prostate, and the vasa deferentia, one or both, can be traced as infiltrated hard tubes. The bacillus tuberculosis may be found in the urine. The course is very slow and the prognosis unfavorable.

**Hypertrophy of the Prostate.**—Diagnostic hint:—Frequency of urination at night in an elderly man points to prostatic hypertrophy.

The patient is a man usually over fifty years of age, who first has difficulty in starting the flow of urine and voids urine too frequently at night, then has the features of cystitis to a greater or less degree. The finger in the rectum encounters a rounded, dense mass, either smooth and symmetrical or vari-

ously distorted and nodulated. The urine at first is too abundant, pale, and of low specific gravity; later, it presents the features of cystitis.

The patient goes on a slow course of varying severity of symptoms, until finally retention of urine takes place as a result of distortion of the prostatic urethra, with elevation of the level at the vesico-urethral orifice, and the use of the catheter is begun. After a varying length of time there is dilatation of the bladder, with hypertrophy; the ureters are dilated, as also the pelvis of the kidney; there is tendency to stone formation, to contracting kidney, and the patient either has suppurative nephritis and uræmia, or dies from uræmia without presenting the features of suppurative nephritis.

**Cancer of the Prostate.**—The patient is usually an elderly man, with a history of injury or enlargement of the prostate, who has free haemorrhages from the urethra, with or without urination; pain, peculiar hardness in the prostate, and possibly enlargement of the glands in the groin and pelvis. The patient may die without any ulceration or breaking-down of the tumor or rectal discharge, and the urine may show nothing abnormal save a little bladder mucus.

In some cases connective-tissue shreds of considerable size are found in the urine.

**Diabetes Mellitus.**—Diagnostic hint:—Polyuria, with urine of specific gravity above 1025, suggests diabetes mellitus.

The patient, if under thirty, loses flesh, is hungry, thirsty and weak. The urine contains sugar and gives the red reaction with ferric chlorid. The patient is better at times, then worse again, and usually dies, within three years, of diabetic coma, preceded usually by gastric crises. The patient, if over thirty, and especially if over forty, may lose more or less flesh, but is likely to be corpulent, and his general condition may be fair for years. He is subject, however, to attacks when he feels weak, his mouth is dry and he voids a good deal of urine. He may be free from excessive hunger, thirst or loss of weight

for years at a time. If he does not succumb to pneumonia or other complications, he may live fifteen or twenty years before the red reaction is obtained in the urine with ferric chlorid, after which he usually grows more or less rapidly worse, and dies of coma.

**Diabetes Insipidus.**—The patient is likely to be under forty years of age. He is very thirsty and voids an enormous quantity of pale urine of low specific gravity. The patient is weak, easily chilled, has a capricious appetite, and complains of a sinking, gnawing sensation in the pit of the stomach.

The disease may last the patient's life-time, but there is danger of development of tuberculosis, pneumonia, or organic brain lesion. Delicate children may die of exhaustion within a few years after the disease develops.

#### PAIN AS A SYMPTOM OF URINARY DISEASES.

The principal points in the significance of pain in urinary diseases are the following :

1. Attacks of intense pain referred to the epigastrium, or to the umbilical region to the left of the median line, with slow, feeble pulse, much prostration and face bathed in perspiration, should suggest movable kidney.
2. Chronic pain in the renal region, like a neuralgia, with restlessness, discomfort, general distress, loss of appetite, frequent and difficult urination, and not relieved by change of posture, also suggests movable kidney.
3. Sudden pain in the back, with vomiting and chills, especially if the heart is weak, suggests renal embolism.
4. Deep-seated pain in the back over the kidneys, aching in the loins, either along the course of the ureters or radiating to the hips, with tenderness over the renal region on deep pressure, suggests acute renal hyperæmia or acute nephritis ; also renal calculus.
5. Headache, when obviously not due to other disorders,

should always occasion the suspicion that some form of renal disease may be present, especially contracting kidney.

6. Headache, with albuminuria, even if there are no other features, should suggest contracting kidney.

7. Earache and noises in the ear are frequently observed in chronic nephritis.

8. An acute, blinding headache, often agonizing, may precede uræmic convulsions in contracting kidney.

9. Headache and burning pain in the epigastrium in a pregnant woman suggest puerperal nephritis.

10. Abdominal pain, with drowsiness, may indicate acute nephritis.

11. A painful swelling in the region of the kidneys should suggest paranephric abscess.

12. Severe paroxysmal pain in the region of one kidney, radiating from the flank into the bladder, suggests renal calculus, renal tenesmus and renal tuberculosis.

13. Pain either fixed or shooting outward and downward from the kidneys, usually a dull or violent continuous aching, not affected by movement, suggests malignant tumor of the kidney.

14. Dull pain in the region of one or both kidneys may be due to pyelitis or to oxaluria.

15. A moderately severe pain, following course of one or both ureters, may indicate pyelitis and ureteritis.

16. Similar pain with grave constitutional disturbance may be due to suppurative nephritis.

17. Constant dull pain in the loin over one kidney or both, long-lasting and accompanied by fulness or tumor, suggests hydronephrosis or pyonephrosis.

18. A dull ache, either fixed or radiating toward the genitals or upper portion of the thigh of affected side, may be due to stone in the kidney.

19. Pain in the lower part of the leg, or in the heel, maybe due to stone in the kidney.

20. A violent agonizing pain, beginning suddenly, especially after exertion, shock or jolt, and cutting, stabbing, sharply defined along the course of the ureter, either toward the genitals or into the thigh (or radiating upwards into the epigastrium), and stopping as suddenly as it began, is renal colic, commonly due to calculus or tuberculosis.
21. Slight pain in one kidney, or severe pain for a time, disappearing for years, or persisting as a constant dull pain in the loin, may be due to calculus in the substance of the kidney.
22. Sudden violent renal pain occurring in paroxysms and not ceasing suddenly, but only gradually wearing off, suggests calculus impacted in the ureter.
23. Severe abdominal pain, chiefly on one side, beginning in the renal region and gradually extending to the bladder, suggests acute ureteritis.
24. A bearing-down pain in the renal region, increased by standing on the feet, suggests chronic ureteritis.
25. A cramp-like pain felt after emptying the bladder, ascending along course of ureter to the kidney, and also radiating to the lower extremity of the affected side, points to spasm of the ureter (renal tenesmus).
26. A distressing, persistent pain, referred to the region of the symphysis pubis and perhaps extending to the perinæum and rectum, somewhat relieved by micturition and aggravated by constipation, is found in acute cystitis.
27. Similar pain, but not so severe, together with backache in the sacral region, more or less headache and leg-ache, points to chronic cystitis.
28. Pain along the urethra, at end of the penis, in the testicles, and down the thighs, especially sharp when there is sudden stoppage of the stream of urine, and then felt most acutely at the meatus, points to stone in the bladder.
29. Pain in the middle of the penis, relieved by sudden stoppage of the stream, points to vesical tuberculosis.

30. Pain in the bladder, followed by haematuria and relieved by it, points to a benign bladder growth. Pain not relieved by intermittent haematuria, to a malignant growth.

31. Severe pain, accompanying the passage of the last drops of urine, points to inflammation of the prostate or prostatic urethra, or to posterior urethritis.

32. The above, with perineal pain and tension, especially points to acute prostatitis; lancinating pain rather than tense, to prostatic abscess.

33. Pain like that of vesical stone, with painful sensation when walking, an increase of it when crossing the legs, from sitting, or in changing posture from sitting to standing, may indicate *chronic prostatitis*.

34. Dull pain and burning along the urethra frequently occurs in *hypertrophy of the prostate*.

35. Pain during urination, either at the head of the penis or along the urethra, with extreme pain accompanying ejaculation during intercourse, points to *seminal vesiculitis*.

#### THE METHYLENE-BLUE TEST.

The method of performing this test has already been described in the chapter on URÆMIA. As to its clinical value, Achard and Castaigne write as follows:

In interstitial nephritis there are evidences of impermeability, such as delayed appearance (frequently), and habitually prolonged elimination period. The authors have often made the diagnosis when other phenomena, such as albuminuria, were not in evidence. Considering the insidious nature of this disease, the test should be of great practical value.

In acute and chronic diffuse nephritis it is quite different. Permeability appears to be retained for a long time. The same holds good for amyloid kidney.

In functional albuminuria a slight prolongation of the period of elimination has been observed.

In passive congestion of the kidneys from cardiac weakness the elimination of the blue does not appear to be interfered with. After the condition is of long standing, irregularities of elimination will appear.

In diabetes elimination appears to be almost normal. If this disease coincides with actual organic disease of the kidney, impermeability is readily apparent.

In urinary surgery operators have employed the blue in doubtful cases to determine whether or not the kidneys are sufficiently impaired to contraindicate operations on the urogenital tract. The method has been combined with urethral catheterization, so that the permeability of each kidney may be ascertained.

It was thought that the blue might prove of service in obstetrical practice, and foretell the possibility of eclampsia through evidences of renal inadequacy; but these hopes have not been realized. An eclamptic may eliminate the blue normally, while a case which eliminates badly will present no evidence of likelihood of eclampsia.

#### URÆMIA IN ITS CLINICAL BEARING.

The reasons why a condition of chronic uræmia may be overlooked are as follows:

1. On part of the patient assumption that nervousness or dyspepsia is the primary cause of his trouble, with result that he spends his time and money doctoring himself with advertised cures for these maladies.

2. On part of the patient, ignorance or disregard of the fact that he is passing less urine than normal. Patients are very quick to notice that they are urinating more frequently than usual, or passing a larger amount of urine than usual, but few seem to notice when the urinary secretion is growing scanty, or to attach importance to a diminution in the quantity. Cases of contracting kidney are not infrequent in persons phy-

sically and mentally active, whose minds are occupied with affairs and who do not think of themselves until they are conscious of unaccountable muscular weakness ; then, on investigation, it will be found perhaps that they are passing only fifteen or twenty fluidounces of urine a day, in which the presence of albumin and casts can readily be demonstrated, and in which urea is less than two hundred grains in amount.

3. On part of the physician, disregard of the importance of examining urine voided during the day. If the patient is merely told to bring a sample of urine for examination, the chances are that he will bring the urine voided on rising in the morning. Now it is a fact that in certain cases of contracting kidney both albumin and casts may be absent from the urine voided on rising. I need not again refer to the case so often quoted by me, in which I failed to find either albumin or casts in the early morning urine of a patient with retinitis albuminurica, six weeks before death from coma. A few months ago I examined the urine voided on rising by a man whose history was unknown to me, and found it practically normal. Later I asked for his day urine, and found in it albumin, casts, blood and pus corpuscles, and crystals.

4. On part of the physician, too much confidence in the presence of a fairly large quantity of urea. I will not deny that in a case where the features and history point to uræmia, and where the patient is voiding less than two hundred grains of urea a day, and where the presence of casts in the urine can be demonstrated, that the case is indeed likely to be one of uræmia, but I do insist that excretion of more than two hundred grains of urea does not exclude uræmia.

5. On part of the physician, too much reliance on the condition of the heart and pulse ; it is indeed true that an albuminuria coinciding with a tense pulse and headache is significant usually of contracting kidney, but a good many cases of uræmia will be found in which cardiac and vascular features are by no means marked, and there are a good many cases

with marked cardiac and vascular symptoms which do not manifest uræmia. Uræmic poisoning, like poisoning by other agents, does not affect all persons alike.

It may not be amiss to recall the fact that occasionally a male child is born with a prepuce so tightly adherent as to close the meatus completely, and thus prevent urination. In the case of any male infant, therefore, when urine is not voided after the usual period of twenty-four to thirty-six hours, examination of the prepuce should be made, if it has not been done before.

It must also not be forgotten that prolonged cases of polyuria from any cause may develop uræmic symptoms from sudden and more or less complete anuria. Not long ago I saw a case of diabetes mellitus of two years' duration, in a young woman, in which death was preceded by sudden diminution in the quantity of urine, appearance of albumin and casts, and finally total suppression for a day or two, all measures for relief of which were futile. (*From a paper in the Medical Visitor by the writer.*)

#### THE URÆMIA OF ELDERLY MEN.\*

The writer has seen certain cases in which old men have died either comatose or in convulsions without much previous indication of this particular termination of their case.

All of them, so far as known, were sufferers from enlarged prostate and cystitis, but the prostatic trouble was not necessarily more severe than in other patients, who as yet show no uræmic tendencies.

It is difficult to discover the actual cause of the uræmia in some of the cases, or even to determine with exactness just when it sets in. It may steal upon the patient in a most insidious way, and is not likely to leave him when once it has become established.

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\* Published in the *Medical Era* by the writer.

Pyelonephritis, terminating in profound coma, is undoubtedly the ultimate cause of death in a large number of prostatic cases, according to Goodhart, in seventy-four per cent.; again, hydronephrosis, with resulting chronic interstitial nephritis, is the cause of uræmia in other cases. But the writer has seen cases in which no evidences of either of these lesions was demonstrable, while yet the patient slowly sank and died comatose.

In order to account for these more obscure cases the writer advances the following hypotheses :

First, the likelihood of the existence of forms of chronic nephritis, not yet well-recognized, but which are intermediate between typical chronic interstitial nephritis and senile contracting kidney, forms in which uræmia is a more prominent feature than the cardio-vascular changes which we expect to see in typical chronic interstitial nephritis. We find, in most cases of uræmia in elderly men, pale urine of low specific gravity, more or less deficient in solids. Urea is not invariably decreased to a marked degree, but uric acid is almost always low. A trace of albumin is found which we commonly refer to the presence of pus in the sediment. Casts are usually absent until late in the case, when a few hyaline or pale granular casts may be found at times.

Inasmuch as various writers have insisted on the existence of forms of chronic nephritis intermediate between chronic interstitial nephritis and senile contracting kidney, it seems not unlikely that the uræmia of elderly men, which is not apparently due to pyelonephritis or to typical interstitial nephritis may be referred to some of these intermediate forms. If such a nephritis is present, it would naturally affect most seriously those whose skin and bowels were particularly inactive, and it is in old men with such a condition of the skin and bowels that the writer has observed chronic uræmia most frequently.

Moreover, in cases of chronic pyelitis or cystitis eventually

proving fatal, interstitial changes in the kidneys are usually observed post-mortem, and though, perhaps, in some the macroscopic changes are not well marked, still a careful microscopic examination rarely fails to reveal interstitial change (Ralfe). The cause of this interstitial change is most commonly due to pressure on the ureters of the thick bundles of muscular tissue of an hypertrophied bladder. Pressure on the ureters causes increased urinary pressure in the kidneys, and increased urinary pressure in the kidneys is known to be a cause of interstitial changes. It is possible, therefore, that in the cases referred to by the writer death from uræmia is due to the existence of an interstitial disease intermediate between typical chronic interstitial nephritis of middle life, without enlarged prostate and cystitis, on the one hand, and senile kidney on the other. We expect to find in typical interstitial nephritis, hypertrophy of the left ventricle, a high tension pulse, atheroma of arteries, and sometimes albuminuric retinitis. But in the cases referred to above the writer has not noticed these conditions, the clinical features being merely those of chronic uræmia, together with urine of poor quality, showing the usual evidences of cystitis. In cases which die from pyelonephritis it is well known that we may find post-mortem evidences of chronic interstitial nephritis intermixed with those of suppurative changes. The writer reasons, therefore, that patients with enlarged prostate and cystitis who die of uræmia without the usual symptoms of pyelonephritis are killed by some form of interstitial nephritis, before pyelonephritis, on the one hand, or hydronephrosis, on the other, has set in.

A second hypothesis, wholly different from the first, and which seems, in the light of our present knowledge, much less likely, is that the uræmia is due either entirely or in part to actual absorption of urinary salts in the bladder itself from residual urine there. We know, for example, from the experiments of Ultzmann that under certain circumstances the bladder is able to absorb certain salts.

Utzmann found that in some cases of bladder haemorrhages, if two fluidounces of a one and one-half per cent. solution of potassium iodide were injected into the washed-out bladder, iodine could be detected in the saliva fifteen minutes later. (*Vorlesungen ueber Krankheiten der Harnorgane*, Vienna, 1888.)

A slow absorption of small quantities of urinary salts might also be possible in an ulcerated bladder. Until, however, we know just what substances are responsible for uræmic phenomena, we can not regard this hypothesis as even probable, but must relegate it to the domain of possibilities. Any argument in its favor would nevertheless be welcomed by the writer as of great interest.

Regardless, however, of theories as to cause, we cannot fail to notice that certain old men with enlarged prostate or with more or less cystitis and pyuria die from some sort of chronic poisoning, which, in a general way, we call uræmia. For some time previous to death the family and friends of a patient in this condition notice the change in him. They say, "The old man is failing—he is not what he used to be."

Dull headache, bodily and mental lassitude, and inertia predominate. The patient's face becomes expressionless and indifferent. He does not always know just where he is or what he is doing. He may wander about the streets for hours without definite purpose or accomplishment. He rouses when spoken to and may reply rationally to questions put to him, but gradually sinks into stupor when left to himself. After a length of time, varying in different cases, he becomes comatose, and all efforts to rouse him are then usually futile. In some cases agonizing headaches, rather than stupor, occur, and death is preceded by convulsions.

The problem of the therapeutic management of such cases seems to be difficult of solution and about the only hope to lie in persistent though gentle eliminative measures in cases where operative proceedings are not feasible.

The accumulation of toxic products is persistent, so that efforts to get rid of them must also be persistent. When we find an elderly patient with obstruction to the free flow of urine, with a bad tongue, a bad breath, constipated bowels, a dry, harsh, inactive skin, who is voiding pale urine of low specific gravity, deficient in solids, especially in uric acid, and containing pus, whether or not we can satisfactorily make the diagnosis of renal disease, it is incumbent upon us to make constant effort to promote elimination. This is not always easy, for so-called vigorous measures may seriously weaken the patient. Removal to a more equable climate than ours, where he can have plenty of sunlight, and gentle exercise in the open air, followed by careful, not too vigorous, bathing and expert massage is to be recommended.

The writer has seen a number of drugs used in large and small doses in the various cases, but cannot report flattering results from any save in one or two instances where Jaborandi seemed to be of benefit.

It would appear from the above and from the fact that death from pyelonephritis or contracting kidney also awaits the patient with enlarged prostate, that operative removal of the obstruction to the free flow of urine should be undertaken, as Adams advises, as soon as retention from obstruction takes place.

#### SEQUENCES AND COMPLICATIONS OF URINARY DISEASES.

Among the more common sequences and complications of urinary diseases we find the following :

1. *A movable kidney* may cause kinking of the ureter, *hydronephrosis*, *pyonephrosis* and *pyelonephritis*.
2. *Injury to the urethra*, or even the passage of a sound, may be followed by *acute hyperæmia* of the kidneys, suppression of urine, coma, and death in less than fifty hours.
3. Long-lasting *acute renal hyperæmia* is likely to result in *acute nephritis*.

4. *Polyuria* from any cause may result in *acute hyperæmia*.
5. Repeated attacks of *acute hyperæmia* may precede the onset of *renal tuberculosis*.
6. Long-continued *chronic renal hyperæmia* may finally result in a fatal *chronic nephritis*.
7. *Acute nephritis* may be followed by *chronic nephritis*, especially *chronic diffuse nephritis*.
8. *Chronic diffuse, non-indurative nephritis* may follow diseases of the lower urinary tract and malignant growths.
9. Cases of *chronic diffuse nephritis* (large white kidney), which do not recover after a year or two, may suffer from *renal atrophy* (atrophic stage of large white kidney, secondary interstitial nephritis).
10. An unrecognized case of *chronic diffuse nephritis* may suddenly exhibit the symptoms of an *acute hæmorrhagic nephritis*.
11. Long-lasting *stricture of the urethra* may be followed by *primary chronic fibrous (interstitial) nephritis* (contracting kidney).
12. *Displacements of the uterus*, resulting in pressure on the ureter, may be followed by *hydronephrosis*, *pyonephrosis* and *pyelonephritis*, or by *contracting kidney*.
13. *Contracting kidney* may be the result of *calculous pyelitis*.
14. *Contracting kidney* by distal constriction of the uriniferous tubules may cause proximal dilatation of them by the urine and formation of cysts (*multilocular cystic kidney*).
15. *Chronic diffuse nephritis* (either large or atrophied kidney) or *chronic fibrous nephritis* (contracting kidney) may either of them become complicated by *lardaceous degeneration* (amyloid kidney).
16. *Lardaceous degeneration* may follow *pyonephrosis* and *paranephric abscess*.
17. *Chronic diffuse non-indurative nephritis* complicated by *lardaceous degeneration* may result in *suppurative nephritis* in one kidney.

18. *Lardaceous degeneration* may have *nephritic* complication.
19. Diseases of the lower urinary tract or surgical operations on the same may result in *abscess of the kidney* (pyelonephritis).
20. *Abscess of the kidney* may extend to the paranephric fatty tissue, causing *paranephric abscess*.
21. *Renal abscess* or *paranephric abscess* may communicate with the renal pelvis, causing *pyelitis*.
22. *Chronic renal tuberculosis* may cause *paranephric abscess*.
23. In women *pelvic cellulitis* may be followed by *paranephric abscess*.
24. *Paranephric abscess* may follow *surgical operations* on the testicle and spermatic cord after inflammation of the connective tissue about the bladder; or it may follow operations on the rectum, perineum or uterus.
25. *Suppurative processes* in the gall-bladder, liver and spleen may be followed by *paranephric abscess*.
26. *Renal tuberculosis* is often preceded by tuberculosis of the testicle, epididymis or prostate.
27. Chronic inflammation of the lower urinary tract may be followed by *ascending tuberculosis*.
28. *Renal tuberculosis* in one kidney may descend through the ureter to the bladder and ascend to the other kidney.
29. Primary malignant disease of the testicles may cause secondary malignant disease in the kidneys (*cancer*).
30. Large retroperitoneal tumors may cause absorption of the kidney and replacement by fat.
31. *Diabetes mellitus* may cause *pyelitis* from irritation by saccharine urine.
32. An *abscess* breaking into the renal pelvis may cause *pyelitis* by irritation; as may the presence of a *foreign body in the pelvis of the kidney*.
33. *Failure to avoid sepsis* after operations on the urinary

tract may be followed by *pyelitis*; *childbirth* may also be a cause.

34. *Acute nephritis* may result in *pyelitis* due to bacterial irritant.

35. *The colon bacillus* may cause *pyelitis*, and this disease may follow even habitual constipation.

36. *Pyelitis* is sometimes a result of gonorrhœa, and of many infectious diseases.

37. *Pyelitis* is frequently followed by *pyelonephritis*.

38. *Chronic pyelitis* of long duration may be followed by *lardaceous degeneration* or *chronic fibrous nephritis* (contracting kidney, primary chronic interstitial nephritis).

39. *Hydronephrosis* may follow urethral stricture, enlarged prostate, renal calculus or displacements of the kidney; spasmodic contraction of the ureter is a noteworthy cause.

40. An operation on the lower urinary tract in a patient with *hydronephrosis* may be followed by fatal *pyelonephritis*.

41. *Chronic fibrous nephritis* (contracting kidney) follows the dilatation of the pelvis in *hydronephrosis*, particularly in a *double hydronephrosis* with progressive enlargement.

42. *Pyonephrosis* may follow from the same causes as *hydronephrosis*, and especially from *stone impacted* in the pelvis of the kidney.

43. *Malignant disease* of organs near the kidney may be followed by *pyonephrosis*.

44. *Renal calculus* may result, if not removed, in serious renal inflammations and degenerations. The kidney may become a mere shell about the stone.

45. *Impaction of the stone* in the ureter may lead to ulceration, perforation, abscess and death from *peritonitis*.

46. *Ureteritis* in women may be followed by *spasm of the ureter* (renal tenesmus).

47. *Ureteritis* may follow either *pyelitis* or diseases of the *lower urinary tract*.

48. *Cystitis* may result from *gout* (hyper-acid urine) or from *diabetes mellitus* (saccharine urine).

49. *Slight cystitis* may follow any infectious disease in which a slight degree of *acute nephritis* exists.

50. *Cystitis* may commonly follow gonorrhœa (irritation from the gonococcus). It may be due to *extension of inflammation* in the urethra or prostate, especially when an unclean catheter is used; it will result from *retention of urine* from any cause, and from presence of *stone or foreign body*.

51. *Injury* is a common cause of *cystitis*; a common injury is pressure from the *fœtal head*. Pressure from *feces* or *perisarties* may cause it, or from a *displaced uterus*.

52. *Cystitis* may result in *prevesical inflammation*.

53. In women *anal and rectal inflammations* are quite commonly followed by *cystitis*.

54. *Fissure in the neck of the bladder* in women is a common cause of symptoms erroneously referred to *cystitis* proper.

55. In pregnant women a *chronic congestion of the urethra* is not uncommon.

56. *Residual urine* is likely to be followed by formation of *stone in the bladder*.

57. *Stone in the bladder* may ultimately be followed by death from *pyelonephritis*, or by *abscess formation* in and about the bladder.

58. *Vesical tuberculosis* may result either from renal tuberculosis or by infection from the prostate and seminal vesicles. More commonly it results from *surface inoculation* by the stream of tuberculous urine from the kidney or renal pelvis.

59. *Tumors of the bladder* about the ureteral orifice may result in *hydro- and pyonephrosis*, *pyelonephritis* or *contracting kidney*.

60. *Bladder tumors*, unless removed, inevitably result in death.

61. *Acute prostatitis* may result from irritation or sexual excess, but more commonly from *gonorrhœa* or *stricture*.

62. *Acute prostatitis* may be followed by *abscess* or by *chronic prostatitis*.

63. In tubercular subjects a severe *chronic tubercular prostatitis* may be noticed.

64. *Enlargement of the prostate* results in distortion of the prostatic urethra, elevation of the level at the vesico-urethral orifice, and obstruction to the return of blood from the bladder.

65. *Enlargement of the prostate* may be, therefore, followed by *retention of urine, cystitis and vesical stone*.

66. *Enlarged prostate* may result in a slight chronic *ureteritis and pyelitis*.

67. *Use of the catheter* may result in *urinary fever* or in swelling of one or both testicles.

68. *Enlarged prostate* results sooner or later in dilatation of the bladder, hypertrophy of it, dilatation of the ureters and renal pelvis, with stagnation of urine, congestion and *catarrhal inflammation of the entire urinary tract, pyelonephritis*, and death from *profound coma*.

69. Cases of *enlarged prostate* may be complicated by *chronic fibrous nephritis* (contracting kidney).

70. In *enlarged prostate* death from *uræmia* is sometimes noticed in patients who have not manifested marked evidences of renal disease. (See writer's paper "*Uræmia of Elderly Men.*")

71. Irregular or ungratified sexual desire may result in a frequent desire to urinate without presence of any inflammatory disease ("*Neuralgia*" of the bladder, *irritability of the bladder*).

72. *Diabetes mellitus* may cause diminution of sexual inclination, disorders of the cutaneous surface, asthma, gastric catarrh, constipation, cystitis, muscular pains, cataract, gangrene, retinitis, insanity, chronic nephritis and coma. It may be cut short by death from *chronic pulmonary tuberculosis* or *acute pneumonia*.

73. *Diabetes insipidus* may lead to exhaustion from loss of rest, thirst and worry.

74. Various diseases of the urinary tract may be due to *irritation from use of drugs*, either internally or by injection:

Acute hyperæmia and acute nephritis to Cantharides, Turpentine, Juniper, Squills, Nitre, Copalba, Cubebs, Mineral acids, Oxalic acid, Carbolic acid, certain salts of Potash (Chlorate, Chromate, Iodide), Phosphorus, Arsenic, Corrosive sublimate, Oil of Mustard, Salicylic acid, Coal-tar compounds, Boracic acid, Opium, sharp condiments; to external applications of Carbolic acid and Iodoform; to frictions with Tar, Storax, Peru balsam, Petroleum, Naphthol, Chrysarobin, Pyrogallic acid; to various ointments used in scabies and psoriasis.

*Acute nephritis* may follow ptomain poisoning.

*Chronic nephritis* would appear to be a sequence of *alcoholism* in some cases.

*Chronic nephritis* (contracting kidney) is often a result of *plumbism* and of chronic poisoning by other metals.

*Pyelitis* may result from elimination of such poisons as Copalba, Turpentine, Cantharides or Cubebs.

*Cystitis* may also be due to the same, or even to mustard or certain kinds of beer; strong injections may cause it.

*Acute prostatitis* may be caused by Cantharides or other drugs, and by strong injections.

75. *Bacterial irritants, toxins, etc.*, are a fruitful cause of renal diseases, as follows:

*Acute hyperæmia*: It is possible that xanthin and paraxanthin may have something to do with death from suppression of urine in acute hyperæmia.

*Acute nephritis* is commonly due to the passage of soluble specific virus through the kidneys, i. e., to products eliminated by pathogenic microbes; and also to sepsis.

*Chronic nephritis* (contracting kidney) is often referable to syphilis, malaria or gout.

*Lardaceous disease* is recognized as the result of the long-continued action of toxins produced by the staphylococcus pyogenes aureus.

*Puerperal nephritis* is thought to be a toxæmia in some cases, but many theories exist regarding it.

*Renal abscess* is due either to the entrance of pyogenic bacteria from the circulation or to extension of inflammation from below.

*Paranephric abscess* and *genito-urinary tuberculosis* may be included in the same general category as the above.

*Pyelitis* may be due to the action of the colon bacillus or to the bacterial irritants of various infectious diseases.

*Pyonephrosis* may sometimes be septic or due to bacterial irritants.

*Cystitis* may be due to the local action of the bacteria or toxins of its primary disorder.

*Acute prostatitis* is often due to the action of the gonococcus.

#### INDEX TO THE ABOVE.

- Abscess of the Kidneys, see Pyelonephritis.
- Abscess of the Bladder, 57
- Abscess of the Prostate, 62
- Atrophy of the Kidneys, 9
- Calculus, Renal, 44, 45
- Calculus, Vesical, 56, 57, 65
- Cancer, Renal, 29, 44, 45
- Cancer, Vesical, 50
- Contracting Kidney, 11, 12, 13, 14, 38, 41, 69
- Cystic Kidney, 14
- Cystitis, 48, 49, 50, 51, 52, 53, 65, 74, 75
- Diabetes, 31, 48, 72, 73
- Enlarged Prostate, see Prostatic Hypertrophy.
- Floating Kidney, see Movable Kidney.
- Hydronephrosis, 1, 12, 39, 40, 41
- Hyperæmia, Acute, 2, 3, 4, 5, 74, 75
- Hyperæmia, Chronic, 6
- Lardaceous Degeneration, 15, 16, 17, 18, 38, 75
- Movable Kidney, 1
- Nephritis, Acute, 7, 10, 34, 49, 74, 75
- Nephritis, Chronic, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 38, 41, 69, 74, 75
- "Neuralgia" of the Bladder, 71
- Paranephric Abscess, 16, 20, 21, 22, 23, 24, 25, 75
- Prostatic Hypertrophy, 64, 68, 69, 70
- Prostatitis, 61, 62, 63, 65, 74, 75
- Puerperal Nephritis, 75
- Pyelitis, 13, 31, 32, 33, 34, 35, 36, 37, 38, 47, 66, 74, 75
- Pyelonephritis, 1, 12, 17, 19, 20, 21, 37, 40, 57, 68, 75
- Pyonephrosis, 1, 12, 16, 42, 43
- Renal Tenesmus, 46
- Stone, see Calculus.
- Stricture, 11, 61
- Tuberculosis, Renal, 22, 26, 27, 28
- Tuberculosis, Vesical, 58
- Urethritis, 46, 54, 55
- Ureteritis, 45, 46, 47, 66
- Urinary Fever, 2, 67

(From an article by the author in the *Hahnemannian*.)

## EXAMINATION OF THE URINE AS AN AID TO PROGNOSIS.

Examination of the urine furnishes us in various ways with means by which we may form an opinion as to the outcome of diseases. The following are among the most important conditions in which knowledge of the character of the urine is of value as an aid to prognosis :

**The Prognosis in Renal Diseases :—**In *acute hyperæmia*, especially that following surgical operations, the prognosis depends on the quantity of urine and its character. Suppression of urine continuing for several days after an operation is a bad sign, the cases usually terminating fatally. Cases in which the urine is scanty (less than ten fluidounces in twenty-four hours) and highly albuminous (twenty to thirty per cent. bulk), with a good deal of blood, are dubious, and demand a guarded prognosis, which becomes favorable as the urine increases, while albumin and blood diminishes.

In *chronic hyperæmia* the prognosis depends on the curability of the disorder causing the chronic congestion. As to immediate prognosis, however, much depends on the examination of the urine. The writer has noticed the tendency of chronically congested kidneys to take on inflammation, shown by increase of albumin and presence of granular casts. When, in the course of a chronic congestion, therefore, we find albumin more than ten per cent. bulk, and granular casts, especially dark ones, present, the prognosis becomes unfavorable as regards time. In several cases the writer has observed no signs of nephritic complication until a few weeks or days before death from uræmia in cardiac failure, but the complication must, as a rule, be regarded as a grave one.

In *acute post-scarlatinal nephritis* the immediate prognosis depends on the quantity of urine, albumin, blood and casts. When the quantity of urine per twenty-four hours falls below ten ounces, when albumin is abundant, blood and casts ditto,

the prognosis must be guarded, becoming favorable as the urine increases and the constituents above named decrease. During convalescence moderate polyuria is often observed, but if the quantity of urine remain above normal, the specific gravity low, and albumin and casts (especially granular and fatty) persist, the prognosis again becomes dubious, on account of danger of chronic nephritis. [It is possible to find *a trace of albumin* and *a few hyaline casts* for months in cases which ultimately recover completely. In one of the writer's cases such was the condition for nine months after the original appearance of albumin, but the urine was normal in other respects.]

A particularly fatal form of acute nephritis is sometimes seen, in which blood and blood-casts are absent, but albumin and casts (not blood-casts) usually abundant. This form is called by Porter acute parenchymatous degeneration, and is always the result of toxic influences, whether from poisoning by various drugs or caused by toxins in the body. The prognosis in these cases is invariably grave, whereas in the usual post-scarlatinal cases two out of three recover. These degenerative cases occur sometimes *in the course of* (not necessarily after) infectious diseases, and the albumin is not always large in amount, but may be only a trace.

In *chronic diffuse non-indurative nephritis* the prognosis depends largely on the condition of the urine after the patient has suffered for a year from the disease. If the amount of albumin and the number of casts, especially fatty, are great at the expiration of a year, the chances are that the patient will not live more than a year, or two more at most, especially if the dropsy is obstinate, resisting all efforts on part of the physician to cause its disappearance. The writer has seen several complete recoveries from this disease in cases less than a year old, and, as a rule, refrains from giving an unfavorable prognosis, even in apparently desperate cases, before this space of time has elapsed.

Some few cases linger several years, and the urine, instead of being below normal in quantity, becomes abundant, pale, of low specific gravity, albuminous still, and containing numerous casts. The prognosis is ultimately unfavorable, as the kidneys are undergoing atrophy in some parts, and life depends on the degree of compensatory hypertrophy of it.

In *chronic primary interstitial nephritis* (contracting kidney) while the ultimate prognosis is unfavorable, it is extremely difficult to predict which way the case is going at any given time, on account of the suddenness of the uræmic attacks. The writer has seen cases in which uræmic attacks occurred with but little warning from the condition of the urine. In general, however, since polyuria is the rule in both cases, *diminution in the quantity of urine with increase in color, while at the same time the specific gravity is below 1015*, is an unfavorable combination. The writer had opportunity to examine the morning urine of a patient who died the same day of uræmia. The amount of albumin was a trace merely, and only three or four casts were found; but the color of the urine was darker than normal, suggesting a specific gravity of 1025 or more, when in reality it was only 1013.

In *lardaceous disease* (amyloid degeneration), when the usually scanty sediment becomes more abundant, and instead of containing a few broad hyaline or waxy casts, now shows granular and fatty ones, nephritic complication has set in, and the prognosis, which before was dependent on the exciting cause (suppurative processes in the body) now becomes unfavorable in all respects.

In several fatal cases of chronic nephritis the writer has observed a marked indican reaction not long before death.

During *pregnancy* the writer finds instructive lessons in prognosis. In cases with history of previous convulsions or of neurotic family history, the prognosis is guarded, becoming unfavorable either to child or mother, or both, when the urine diminishes suddenly in quantity, when urea increases in

grains per ounce, and albumin increases greatly in bulk. The lesson from casts is not always of value. In one of the worst cases of convulsions the writer ever saw, there were but few casts to be found, and these small, hyaline in kind. The peculiarity of the puerperal cases is that the percentage of urea (grains per fluidounce) is often high (twelve to seventeen grains), whereas in the uræmic attacks of true nephritis the relative quantity of urea is usually low, or at least below normal on a basis of forty ounces per twenty-four hours. The books say "urea is diminished" in puerperal nephritis, so-called, and so it is in quantity per twenty-four hours; but the writer has observed in three or four fatal cases a *high percentage* of urea in grains per ounce a day or two before death.

Whether this increase in percentage of urea is merely a sign of deficiency of water or not is difficult to say. Some who discuss the matter with the writer regard it as of no diagnostic or prognostic importance, but in the writer's judgment the increase in grains per ounce of urea is to be regarded as an evidence of an effort of the body to get rid of urea and of toxins, and such increase is usually out of proportion to the diminution in the quantity of urine, accompanied as it often is by remarkable deficiency of other solids, so that the ratio of urea to salts is two to three times as high as normal. The writer regards, then, an increase of urea (in grains per ounce above ten), coupled with a high ratio of urea to salts, and a great increase in the percentage of albumin, a sign of impending convulsions during pregnancy.

Leaving renal diseases and turning to other disorders, we find here and there useful hints in prognosis from examination of the urine.

1. *In diseases in which there is exudation*, like pneumonia, marked increase in the quantity of solids in the urine is a good sign, indicating, as it does, that elimination is not defective.

2. In exudative disorders, and also in fevers and acute dis-

eases like typhoid fever, a high temperature with deficient excretion of solids in the urine is a bad sign, indicating defective elimination. (See Urinary Analysis by writer, pages 30 to 35, for methods of determining the solids in urine.)

3. Women who pass less than 300 grains of total solids are in a serious condition, since bronchitis, neuralgia, perimetritis or pleurisy may result from taking cold.

4. In *diabetes mellitus* the red reaction with ferric chlorid in the urine is a bad sign, indicating as it does approaching coma. Whenever the physician finds sugar decreasing in the urine of a patient with diabetes mellitus, test for diacetic acid and also for albumin, and examine carefully for casts. The writer has seen several cases in which reduction in the quantity of sugar was *not* followed by improvement, but the reverse. Either diacetic acid appeared, or else the patient became nephritic. In the latter case the prognosis, though ultimately unfavorable, is not so bad as to time as when diacetic acid appears.

The writer has found fatality in diabetes mellitus associated with increase in the quantity of *urea*. That is to say, the prognosis as to time is not so good in a case passing 900 grains as in one passing 350 to 500. The quantity of urea evidently in such cases is an index of tissue destruction.

5. In *Addison's disease* the writer deems the ratio of urea to phosphoric acid of diagnostic and possibly of some prognostic importance. In one case (confirmed post-mortem) which the writer had under observation for several years, this ratio increased as the patient grew worse, becoming above twenty to one at times.

6. In *diseases of the stomach and intestines* Rosenbach's reaction, when constant and continued in spite of medical efforts, is of bad prognostic significance (Urinary Analysis, page 124).

7. In *typhoid fever* hæmatoporphyrinuria is deemed a bad sign. Urine containing hæmatoporphyrin presents an abnor-

**PATHOLOGY OF NON-SUPPURATIVE RENAL LESIONS. 663**

mal color, ranging from sherry or port wine tint to Bordeaux-red. This color is noticed in the urine of patients taking sulfonal.

8. In *typhoid fever* the presence of pathological urobilin is held to indicate hepatic incompetence, and is a bad sign (Urinary Analysis, page 238).
9. In *phthisis pulmonalis* continued presence of the diazo reaction is of bad omen (Urinary Analysis, page 242). (From an article by the author in the *Medical Visitor*.)

**THE GROSS PATHOLOGY OF NON-SUPPURATIVE  
RENAL LESIONS.**

For the convenience of students the following table has been arranged :

664

## **CLINICAL MEMORANDA AND SUMMARY.**

NON-SUPPURATIVE RENAL DISEASES.—*Synopsis of the Gross Pathology.*

(From notes by Dr. B. J. Stevens on the lectures of Prof. Clifton Mitchell; M. B.)

NAME OF LESION.	SIZE OF THE KIDNEY.	CONSISTENCE.	APPEARANCE OF SURFACE.	APPEARANCE OF SECTION.
I. Active hypertension.	Larger than normal.	Kidney firm.	Dark red.	Darker than normal. Bases of pyramids bluish. Glomeruli distinct.
2. Passive hypertension. (Recent Kidney more or less swollen; en; thicker cases.)				Darker than normal. Looks as if cooked. Cortex marked with reddish striæ. Pyramids darker than cortex.
3. Passive hypertension. (Cases of Not larger; may be smaller. Increased long standing, <i>cranioic induration</i> .)				Dark red. Cortex paler than pyramids. Veins appear as dark vertical striæ.
4. Acute parenchymatous nephritis.	Sometimes normal; usually somewhat enlarged.	Harder than normal.	Paler than normal. Greenish yellow in the kidney of pregnancy.	Pale; looks as if cooked. Cortex marked with reddish striæ. Pyramids darker than cortex.
5. Acute diffuse nephritis ( <i>&amp; glo.</i> ). Varieties: usually enlarged, diminished. Kidney more sometimes nearly twice normal size. May weigh nearly 400 to 500 grams.			Gray red; grayish-red; dark red, mottled with red and white points.	Cortex wider; dull gray, pink or gray-yellow. Gloméruli prominent red points; striations indistinct. Pyramids pale or dark red.
6. Acute interstitial nephritis.	Normal or slightly larger. Diminished. Kidney soft, sometimes two or three times normal.	Pale, grayish, opaque, mottled with hyperemic areas.	Opaque grayish with small hyperemic areas. Cortex much wider than normal. Pyramids darker than cortex.	Oily. Cortex wider than normal than cortex or yellow like cornea.
7. Chronic diffuse non-indurative nephritis. (a) <i>large white kidney</i> .	Variable; usually enlarged. Sometimes twice normal.	Smooth gray-yellow or butter-yellow.	Mottled due to alternating gray-yellow and reddish areas.	Cortex wider than normal, marked with reddish striæ or patches.
8. Chronic diffuse non-indurative nephritis. (b) <i>large mottled kidney</i> . ( <i>chronic hemorrhagic nephritis</i> .)	Normal or slightly enlarged.	Larger than the softer; flaccid, doughy.	Smooth or slightly granular. Dark red or mottled, gray-yellow.	Cortex varies in width; opaque mottled, gray-yellow, alternates with reddish areas.
9. Chronic diffuse indurative nephritis. (a) <i>secondary chronic interstitial nephritis</i> .	Normal, larger or smaller. Increased.	Normal.	Cysts may occur.	Cortex greatly reduced in size, highly granular. Color motley. Cysts usually reddish. Often present. Capsule adherent.
10. Chronic diffuse indurative nephritis. (b) <i>primary chronic interstitial nephritis</i> , or <i>contracted kidney</i> .	Smaller than normal. May be one-third normal size or less.	May increase. May break on cutting through.	Knife Granular. Color varies.	Deposits of lime salts and urates seen. Cortex reduced; thick, hard, friable, pale-yellow.
11. Chronic diffuse indurative nephritis. (c) <i>arterio-sclerotic kidney</i> .	Normal or smaller, rarely enlarged.	Kidney hard.	Cyanotic or reddish. "beefy."	Pyramids dark, congested. Arteries project and gape like small stiff tubes.
12. Amyloid kidney. (The pure form. The kidney may appear normal to the naked eye, but the Iodin test or the gentian-violet reveals amyloid areas.)				
13. Amyloid large white kidney.	Much larger than normal; increased.	Pale yellow, somewhat thick, hard, friable, pale-yellow translucent, like bacon.	Pale yellow, somewhat thick, hard, friable, pale-yellow may be nearly twice normal.	Core covered with gray-red spots, or marked with reddish stains.
14. Amyloid contracted kidney. In "syphilitic cases"				Like contracted kidney. Like contracted kidney, slightly larger.

In making post-mortem examinations, Nos. 3, 7, 8, 9, 10, and 13 are frequently called cyanotic kidney, large white kidney, small white kidney, small red or granular kidney, and waxy kidney, respectively.

#### CLINICAL NOTES.

The following clinical notes have been made by the author since the body of the book went to press :

#### THE COLLECTION OF URINE FOR EXAMINATION.

It must be borne in mind by any one who examines "a bottle of urine" that his report is assumed by the patient to indicate the general character of the latter's urine. If there is "nothing the matter" with the "bottle of urine" the patient assumes that there is "nothing the matter" with any urine voided by him. Hence the necessity for care in collecting the urine for examination and the desirability of making repeated examinations.

The writer has, for fifteen years or more, urged patients and physicians to collect the twenty-four hours' urine for examination, keeping the day urine apart from the night and furnishing also in addition a sample of urine voided as recently as possible. Nurses should be taught to practice the same method of collection in cases under their care, and it should not be assumed by the physician that the nurse knows how to collect the twenty-four hours' urine properly.

In cases of suspected intermittent albuminuria and glycosuria, if nothing abnormal is found on some one day, repeated examinations should be made.

The writer in some cases requests patients to furnish the urine of each micturition for the twenty-four hours' collection in separate bottles and labeled with the hour the urine was voided. It is unfortunately true that some cases of kidney disease may not on certain days show evidences in the urine

of the serious condition present. The utmost care is necessary in order to prevent mistakes. If an examiner known to be competent has at any time found albumin and casts or sugar in the urine of a patient, the writer advises extreme caution in assuming that a mistake has been made and that the patient is healthy, even if nothing indicating the contrary can be found in subsequent examinations.

Every now and then a patient who is a great water drinker sends his urine for analysis. In such urine it is hard to procure much sediment even by use of the centrifuge, and a few tube casts may be easily overlooked unless an unusual number of slides be examined. It is always advisable, when the patient collects his twenty-four hours' urine, for him not to drink any more water than is absolutely necessary to quench his thirst, in order that the urine shall not be too much diluted ; it is also desirable that he take the usual amount of exercise, for the latter, as a rule, tends to cause the appearance of albumin and tube casts in greater amount than when the patient is at rest.

The lesson from these cases can be summed up in the following advice : When you examine the urine of a patient have him collect the entire quantity for twenty-four hours, day and night, in separate bottles, and an extra sample voided just before the examination is made. Examine these three samples separately for albumin, sugar and casts ; then mix the day and night samples, and make the usual quantitative analyses for urea, uric acid, and so on. If your examination is negative as regards albumin, sugar and casts, but there is reason to suspect that at some time or other, one or more of these constituents has been present, make repeated examinations, especially of urine voided during the daytime or when for any reason the patient is fatigued. If the patient is in the habit of dissipating or of dining out and eating heartily, ask for the urine passed during the twenty-four hours following such indulgence. (*Article by the author in The Homœopathic Student.*)

## CRYOSCOPY.

Allusion has already been made to the use of cryoscopy in the diagnosis of uræmia.

The method of determining the freezing point of urine by Beckmann's apparatus is as follows:

A thermometer capable of being read to  $0.001^{\circ}$  C., is supported by a cork in a large test-tube (A) containing the urine. The thermometer is arranged so that its bulb is entirely covered by the urine and does not come closer than 5 mm. to the walls of the tube. Through this cork also passes a rather stiff wire for stirring the urine. Sollmann recommends a rolled-gold wire wound in the form of a spiral, as the most useful. This test-tube fits through a cork into a somewhat wider tube (B), which in turn is supported by an appropriate device in a jar containing a mixture of cracked ice and salt of a temperature about  $-5^{\circ}$  C. The Beckmann's thermometer is graduated into  $0.01^{\circ}$  C., but the freezing point is arbitrary and must be controlled daily by testing it on distilled water, or more conveniently a standardized one per cent. solution of sodium chloride, as below.

To determine the freezing point of any liquid with the apparatus the tube (A) is plunged directly into the freezing mixture, stirring the tube steadily with the wire. The freezing mixture is also stirred occasionally. The mercury will be seen to recede from the reservoir and descend into the stem; at a certain point it will suddenly reverse its direction and ascend. The tube is now removed from the freezing mixture and (B) is set into the mixture. The stirring of (A) is meanwhile continued. The urine is seen to be filled with small crystals of ice. It will be noted that the mercury soon comes to a standstill, which approximately corresponds to the freezing point of the liquid. The stirring is continued until the ice is almost but not quite completely melted. Care

should be taken that the mercury does not rise more than  $0.2^{\circ}$  C. above the freezing point. When the ice has melted sufficiently the tube is plunged for a moment into the freezing mixture, and is then set into the tube (B) which in its turn rests in the freezing mixture, the stirring being continued. The point at which the mercury remains constant is the freezing point. The tube (A) is taken out again, stirred until the greater part of the ice is melted, and the freezing point is taken as before. The two determinations should agree to  $0.003^{\circ}$  C., but one agreement of  $0.002^{\circ}$  C. is sufficient for most clinical examinations. Thermometers with fixed freezing points, while not so delicate, are yet sufficiently accurate for clinical work.

The depression of the freezing point below that of water is denoted by the sign  $\Delta$ . The normal variations of this depression for urine lie usually between  $0.9^{\circ}$  and  $2.1^{\circ}$  C., especially if the quantity of the urine is between 900 and 1700 C.c.; exceptionally  $\Delta$  may range between  $0.1^{\circ}$  and  $3^{\circ}$  C., even in healthy individuals.  $\Delta \times$  C.c. of urine in 24 hours gives the measure of the *gram-molecules* (molecular weight of substance expressed in grams) excreted per day, the value of which in normal individuals lies between 770 and 3,560; mean, 1,700. This factor shows the output of molecules in the 24 hours; it varies with the activity of the kidneys, with the activity of the circulation, and with the metabolism or salt income. Sollmann thinks the most useful factors for clinical purposes may be expressed by the following tables, when the patient is on a diet which contains a normal and fairly constant quantity of common salt, NaCl:

Quantity.	$\Delta$	$\Delta \times$ C.c.	NaCl %	$\frac{\Delta}{\text{NaCl} \%}$
Usual variations . . . {	800 to 1500 C.c.	0.92 to 2.14	900 to 2000	0.4 to 1.2

	N %	Per Day. NaCl.	Per Day. N
Usual variations . . . . .	1.0 to 2.0	8.0 to 15.0	10 to 20

According to Sollmann the most characteristic differentiation of renal disease from heart disease is that in renal disease  $\frac{\Delta}{\text{NaCl}}$  and  $\Delta \times \text{C.c.}$  and  $\Delta$  all tend to be lowered; whereas

in circulatory changes  $\frac{\Delta}{\text{NaCl}}$  and  $\Delta$  vary inversely to  $\Delta \times \text{C.c.}$  When a low  $\Delta$  exists, especially when associated with a low  $\Delta \times \text{C.c.}$  and a low  $\frac{\Delta}{\text{NaCl}}$ , the evidence is fairly strong in favor of renal disease.

If such is not the case, nephritis cannot be excluded. Indeed, the normal limits are so large that cryoscopy cannot be considered a delicate method of diagnosing renal disease.

The value of the method is much greater if instead of "nephritis" we use it to investigate the competence of the kidney. Thus, a low  $\Delta \times \text{C.c.}$ , and especially a low  $\delta \times \text{C.c.}$ , indicates a deficient secreting power for urea; ( $\delta = \Delta - [\% \frac{\Delta}{\text{NaCl}} \times 0.61]$ ):

high,  $\Delta \times \text{C.c.}$ , with low  $\frac{\Delta}{\text{NaCl}}$  an increased permeability of the kidney, etc., according to the scheme given above. The following tabulation may also prove helpful:

*Significance of Changes of Physical Factors.*—Low  $\Delta$ : Diuresis; lessened absorbing power of the kidney; lessened metabolism (starvation).

High  $\Delta$ : Efficient absorbing mechanism; water withdrawal.

Low  $\Delta \times \text{C.c.}$ : Slowed renal circulation (cardiac disease); impermeability of renal epithelium of glomerulus; low metabolism (starvation); salt withdrawal; water withdrawal.

High  $\Delta \times \text{C.c.}$ : Efficient function of the kidney; abnormal permeability of kidney; increased metabolism; salt administration.

Low  $\frac{\Delta}{\text{NaCl}}$ : Diuresis; salt administration; deficient absorbing power of the kidneys; inefficient power of excreting urea; deficient nitrogen metabolism.

High  $\frac{\Delta}{\text{NaCl}}$ : Salt withdrawal; starvation; slowed renal circulation (cardiac disease); increased nitrogen metabolism; impermeability of glomerulus.

The composition of the urine is merely an *aid* to diagnosis. Considered as such, it will well repay the investigator. But if any one approaches the subject of cryoscopy with the expectation that it will solve on every patient the questions of physiology and pathology which have so far withheld even post-mortem investigation and direct experiment, he is doomed to disappointment.

*Uræmia*.—The cryoscopic changes in uræmia do not appear before clinical symptoms, are not quite constant, and have, therefore, very small diagnostic value. Much more can be judged from the  $\Delta$  of the blood; an increase of this almost invariably occurs, and is proportional to the gravity. V. Koranyi found it normal in a few days of his fatal cases, but this altogether exceptional, and can scarcely be considered true uræmia. The urine was found by Claude and Balthazard

to show very low  $\Delta \times \text{C.c}$ . and  $\delta \times \text{C.c}$ .  $\frac{\Delta}{\text{NaCl}}$  is usually low, but may be rather high when the circulation has become greatly slowed.

*Cryoscopy of Urine as a Means of Surgical Diagnosis*.—According to Waldvogel one of the most valuable features of cryoscopy is to determine the efficiency of the kidneys when one of them is to be excised, and in relieving the anxiety of the surgeon when this excision has been performed.

He states that if the urine possesses a  $\Delta$  superior to 1.0, excision of one kidney may be safely done. After the excision the  $\Delta$  and  $\delta \times \text{C.c}$ . are abnormally low for a day in any case, but if the remaining kidney functionates properly, they should recover their normal value on the following day,

and after that for some days they are abnormally high. But if the  $\Delta$  and especially the  $\Delta \times C.c.$  do not recover after this second day, there must be grave fears that the remaining kidney is also diseased.

**The Clinical Value of Cryoscopy.**—Dr. Gaetano Florio (*Gazetta degli ospedali e delle cliniche*, July 6th) concludes as follows as regards the clinical significance of cryoscopic examinations: The cryoscopic examination of urine gives very important clues as to the functional state of the kidneys. The urine of twenty-four hours should be collected for the freezing test, but it is not necessary to obtain the urine from each kidney by ureteral catheterization. The freezing point of urine taken from the bladder in a case of unilateral renal disease is different from that of a case in which the lesion is bilateral. When one kidney is diseased, the freezing point does not reach below 0.95, while, when both are diseased, it is nearer to 0.45 or 0.30. The proteid substances, such as albumin, pus, etc., do not take part like the crystalline substances, in influencing the freezing point in the urine, and therefore cryoscopy offers a means of differentiating most readily cystitis from pyelitis and pyelonephritis. This fact also explains the independence of the freezing point from the specific gravity, which may be increased by the proteid substances.<sup>16</sup>

**On the Elimination of Urinary Products in Chronic Interstitial Nephritis.**—Dr. Claude, of Paris, at a recent meeting of the Hospital Society of that city, after alluding to the generally-accepted view that in chronic interstitial nephritis renal permeability is diminished, reported the results of the researches of Dr. Burthe and himself in this condition. They employed both cryoscopy and chemical analysis. They found that, on the contrary, the elimination of renal products is rather increased for a long time, and only towards the end of the disease does the quantity fall. Complications may bring about the same result. This is easily explained by a study of the evolution of these lesions. As is known, there is a pro-

gressive development of interstitial tissue in the kidneys, with a confluence of islets of sclerosis which were at first disseminated. Simultaneously the blood-pressure rises and the heart becomes hypertrophied. Those parts of the kidney still unaltered undergo compensatory hypertrophy, and the remaining glomerulo-tubular systems thus modified become the seat of very pronounced activity. These glomeruli, with blood circulating in them at a very high pressure, filter out a great deal of fluid charged with excretory products. By this sort of balance which is maintained between the hypertrophic heart and blood at high pressure and the distended capillaries in the glomeruli, elimination becomes abundant, and even increased above the normal, when the heart is particularly strong. But if this compensation be broken by an infection bringing about a myocarditis or a glomerulo-tubulitis, then renal incompetency, more or less lasting, follows. Finally, the atrophic sclerotic process may eventually cause complete destruction of the glomeruli, and, elimination becoming lowered, the symptoms of uræmia set in. (*La Semaine Médicale*, No. 49, 1902).<sup>4</sup>

**Abnormal Nitrogenous Metabolism.**—Behrens puts the patient on a diet consisting of 1.5 liters of milk, 6 eggs, 250 grammes of white bread and 45 grammes of butter daily for three or four days. The nitrogen in this diet amounts to about 13 grammes. The twenty-four hours' urine is collected and measured each day, the amount of urea determined by the usual methods and the quantity obtained multiplied by the fraction seven-twelfths, the result being the quantity of nitrogen excreted. If the figure found differs materially from 13, the inference is that there is abnormal nitrogenous metabolism.<sup>17</sup>

**Trauma as a Cause of Acute Nephritis.**—Owing to injury, (1) the epithelial or connective tissue elements may be so affected as to degenerate, or (2) a reflex hyperæmia may result, or (3) microbial elements may find a favorable soil for de-

velopment. Cases are reported by Odin, Chevains, Roussel and Dock of nephritis following abdominal injuries.

**Renal Infarct.**—After fully reporting a case of renal infarct in a man of forty-five, Schmidt concludes that embolism in the renal artery causes acute vesical symptoms, retention of urine with incontinence. Polyuria follows, due to active hyperæmia with vasomotor paralysis. With this sudden pain and albuminuria are noted. Hæmaturia but rarely occurs. All sorts of cells are found in the urinary sediment when renal infarct is present. When infarcts are bilateral, lying on the least-affected side causes an increase in the pain. Sudden vomiting may be the first symptom of an embolus of the renal artery. Though a rise in temperature may occur, the condition remains aseptic. When there is a suspicion of renal infarct, sensory changes should be sought in the region supplied by the ilio-hypogastric nerve.

**Treatment of Scarlatinal Nephritis.**—F. Huber recommends the following:

If the case is seen early, and the urine is scanty and dark, plain or carbonated water with a little bitartrate of potassium may be given frequently, and will often produce diuresis. Elimination through the skin and bowels should be encouraged, but not simultaneously, for these organs are antagonistic in their functions. In the acute inflammatory state of the kidney, irritant diuretics are contra-indicated. Water, with or without cream of tartar or the other vegetable salts of potassium, should be given freely.

Flushing the colon with hot normal salt solution, introduced high up in the rectum through a colon tube, will dilute the toxins and cause diuresis. Some favor the subcutaneous use of water by means of hypodermoclysis.

Calomel, one-twentieth to one-tenth grn. every hour, is useful as a gastric sedative, a diuretic and a laxative. It may be continued for many days, stomatitis being a rare complication. Ammonium carbonate in small and frequent doses is

serviceable in severe dyspnoea or threatening pulmonary œdema. Dry-cupping and strychnine may also be employed in such cases. Convulsions indicate hot packs, chloral per rectum, and salt water irrigations. In coma, the caffeine-sodium benzoate may be given hypodermically as a stimulant and diuretic. Renal hemorrhage is treated by hot applications over the loins, mustard plasters, and absolute rest. Hot-air baths and hot packs are useful in great œdema and dyspnoea. Alcohol is contra-indicated, but in severe cases dram doses of cold champagne and ice every ten to thirty minutes have tided the patient over the critical moment.

Desperate cases frequently recover. As to convalescence, the patient must be kept in bed or at least indoors until all albumin disappears from the urine. The anaemia calls for iron, and the myocardial weakness for strychnine in suitable doses. Water, or carbonated water, should be given freely, and diet ought to be light and digestible.<sup>1</sup>

Baginsky (*Jahrbuch für Kinderheilkunde*, vol. liv.) observed eighty-eight cases of scarlatinal nephritis in his hospital during the past five years. The earliest day of the scarlatina on which the nephritis developed was the sixth, and the latest was the thirtieth. The majority of the cases began with fever, and those with marked fever proved to be especially dangerous. The quantity of urine was increased at first in some cases. In eighteen children a chronic albuminuria remained, and in five of these unmistakable signs of chronic nephritis developed. Cases treated in the hospital from the onset ran a decidedly more hopeful course than those admitted later. The cause of this is the treatment, consisting of four weeks' rest in bed and two weeks' absolute milk diet. Venesection is recommended for uræmia, and tannin for long-standing haematuria.<sup>2</sup>

**Nephritis From Salicylates.**—According to H. Luethje and others, salicylates are capable of producing true nephritis.

## THE KIDNEY OF PREGNANCY.

K. A. Hertzfield, in *Centralblatt f. Gynekologie* (Leipsic), October 5, 1901, and translated in the *Journal of the American Medical Association*, November 30, 1901, says: "In looking over the reports of eighteen thousand dissections at the Vienna Institute of Pathology during the last ten years, eighty-one cases of eclampsia were found. In thirty-eight the record described indications of chronic nephritis; in twenty-five, of parenchymatous degeneration of the kidneys, and in eighteen, compression of both ureters. Compression of the ureters was observed in the majority of the cases of eclampsia in primiparae. In thirty-two out of the eighty-one cases a hæmorrhagic hepatitis was mentioned, with compression of the ureters in four; in twenty-one cases no macroscopical alterations were noted in the liver, but compression of the ureters had occurred in ten. Chronic Bright's disease, with more or less severe changes in the heart, was found in forty-six, 56 per cent. of the cases; bilateral compression of the ureters in 22.3 per cent., and acute nephritis in 31.1 per cent. The conclusion from these data seems evident that in the majority of cases of eclampsia there is an existing predisposition to some lesion or affection of the urinary system. This assumption is further sustained by the fact that the cases in which the eclampsia appears in the early stages of pregnancy are considered the most severe. They are almost inevitable cases of pre-existing severe nephritic processes, an important point for the prognosis."<sup>1</sup>

[In five cases of chronic nephritis which the author has seen and now has under observation, pregnancy and confinement were unaccompanied by eclampsia; all the patients and all the children are alive. Four of the patients, however, became anæmic after confinement. One is apparently well at the present time, one year after confinement, but albumin is still present in small quantity in the urine.]

The observations of Stroganoff on eclampsia are of interest. Of his one hundred and twenty-six cases, eight died. He concludes :

From its pathological characteristics, eclampsia is a special form of disease which affects women in pregnancy, labor, in the puerperium, and rarely new-born children. It affects more frequently primiparæ, twin pregnancies and women suffering from diseases of the kidneys.

It is a disease of short duration, accompanied by some fever, and does not necessarily occur in the same women in successive pregnancies, though it may be repeated in the same pregnancy.

In some years eclampsia occurs in a benign form, while in other years it is especially malignant. In some sections, also, it is a disease of great rarity. It is most frequently observed in lying-in hospitals.

The disease may affect women with healthy kidneys, and in seventy per cent. of the cases the prodromal symptoms appear before the attack (several hours).

Eclampsia often occurs in groups of cases, as in lying-in hospitals, where it appears to follow other cases. The isolation of the eclampsia cases leads to a diminution of such cases in the clinic.

The writer concludes from these premises that eclampsia is a special form of disease, with characteristic clinical, pathological and anatomical appearances ; that the theory of its foetal origin is not proven ; and that the theory of infection explains this disease in a more simple and a more logical manner, as the disease is more common in hospital than in private practice.<sup>4</sup>

Fehling mentions that eclampsia has occurred in his experience in only five per cent. of his patients with "pregnancy albuminuria." The prognosis of "pregnancy kidney" is usually favorable in the absence of eclampsia and premature detachment of the placenta. The latter is almost invariably

fatal for the foetus. In case of chronic nephritis pregnancy should be prevented. If a pre-existing chronic nephritis becomes much aggravated during a pregnancy the family physician should consult with an obstetrician as to the advisability of inducing premature delivery.<sup>2</sup>

Judd, in the *Brooklyn Medical Journal*, advocates venesection, Veratrum viride where the pulse is above sixty per minute, Morphine in half grain doses repeated if necessary, Choral by rectum in doses of 40 to 60 grains, hot wet pack, free catharsis by Croton oil or Elaterium if the patient is unconscious, or Epsom salt if conscious, Chloroform to control convulsions, and saline effusion.

Reddick has used Norwood's tincture hypodermically in doses of from fifteen to thirty drops without bad results and in a number of cases there were no return of convulsions after the first dose.

**The Indications for the Induction of Labor.**—(Hofmeier.)—In nephritis, as an indication for the induction of labor, we must differentiate between chronic nephritis and the nephritis of pregnancy. In chronic nephritis pregnancy is to be interrupted if, in spite of treatment, the secondary signs of the disease do not improve, but grow worse. In nephritis of pregnancy, special attention must be given to the danger of eclampsia and the operation is indicated if the symptoms progressively increase in spite of dietetic treatment.

The induction of premature labor for hyperemesis is occasionally necessary as a last resort. It is also necessary for albuminuria and nephritis if improvement does not follow a strict milk diet. In eclampsia of lesser degree Morphine and milk diet should be first tried.

In amaurosis and retinitis, premature labor should be induced at once. Diabetes gravidarum has a bad prognosis; one-fourth of the mothers die, and most of the children perish.

Pregnancy should be interrupted in the earlier months, and

in the second half if there is a high percentage of sugar otherwise, the operation may be delayed until the child is viable.<sup>4</sup>

**Fever in Uræmia.**—The cases are generally of two classes, first, those in which the symptoms are slow in approach and, second, those in which the onset is very sudden. The first class may resemble typhoid in the onset. A typical case of the second class, of rapid onset, is as follows:

A case of acute nephritis in which the temperature is normal until the patient shows symptoms of uræmia. The temperature quickly rises to 102°, when convulsions appear, the temperature then jumps up toward 104° or thereabouts. After nearly a week of this condition there is a decline in the fever and the temperature remains normal until another attack of uræmia appears, which is ushered in by dimness of vision, headache and rise in temperature to about 101°. Stengel has reported a number of cases in which he has noted a rise in temperature before the first convulsion. He reports one case especially in which there was a period of five days of slow fever with a mild uræmic condition before convulsions appeared.<sup>5</sup>

**Diet in Nephritis.**—Koester has studied the effect of diet on the albumin and sediment in twenty-six cases of nephritis. His conclusions are as follows:

Acute nephritis, or acute exacerbations of the chronic variety, should be treated with strict milk diet as long as the exacerbation lasts. In chronic nephritis one may without risk allow a mixed diet, including both red and white meat, with exception of spices and alcohol. It is unimportant whether one give red or white meat. Ascites or œdeema are no contraindication to a mixed diet, if a patient desire it. At times it is of advantage to interrupt this diet, and to put the patient on milk alone for a while.

Aasar agrees with Koester that a strict milk diet is insufficient in chronic nephritis, and might be even injurious. He

has seen patients who had been feeding on milk pick up after being allowed a mixed diet. Also, in a number of cases following scarlatina and diphtheria, he has permitted a number of patients to have bread, fish, bread and butter, and a few a little meat, prohibiting coffee and alcoholic beverages. He has never observed any unfavorable results from these foods, nor has he seen uræmia follow. On the contrary, several patients who had been drinking milk did become uræmic.

Sivén concludes from experiments on himself that one should attempt in nephritis to keep the patient on a diet poor in albumin, but rich in fat and carbo-hydrates.<sup>4</sup>

Favill holds that the general view that red meats are disadvantageous for this class of patients is, to a certain extent, erroneous, and that most of them can take red meats with as great impunity as white meats.

W. H. Porter says: "A well regulated mixed diet, especially if composed largely of the animal class, when it can be tolerated, yields the best results." Croftan opposes milk diet.

**The Treatment of Chronic Nephritis with Mineral Waters and Mineral Baths.**—Von Noorden holds that water may be harmful. He announces, in the first place, that in cases of contracted kidney and the early stage of heart weakness the elimination of the products of metabolism is not influenced to any extent by a reduction of the amount of fluid taken daily. Albumin does not seem to be materially changed either by an increase or decrease in the amount of liquid ingested. Moreover, in Bright's disease, when the heart is failing, a diminution of the quantity of water proves beneficial. The reduction of the quantity of liquid is advised in the early stages. Von Noorden has also noticed that after the ingestion of a large quantity of water in contracted kidney there is enlargement and weakening of the heart. In the advanced stages, with a corresponding degree of arterio-sclerosis, with hypertrophy of the heart, restriction of liquid is imperative. The average quantity of liquor advised is two pints. Prof. Ewald confirms Von Noorden.

The bath treatment was based on the assumption that the action of the skin had a certain connection with the functions of the kidneys, and that by stimulating the former a disorder of the kidneys might be benefited. J. M. Groedel (*Treatment of Chronic Nephritis, Practitioner, December, 1901*) has never seen any curative results from the drinking of waters. His experience is that the bath treatment, in cases of parenchymatous (diffuse) nephritis, is contra-indicated. He divides cases of contracted kidneys into two groups. In the first group are those in whom the circulatory system is not greatly disturbed. The second group consists of those who show an advanced degree of insufficiency of the heart, which is more or less distinctly dilated. In the first group of cases the Nauheim baths are suitable, but in the second group baths are contra-indicated. It has been said that carbonic acid saline baths always increase the blood pressure, but this is not the fact, and it has been proven that in cases of arterio-sclerosis we are able to regulate the baths in such a way as not to increase the blood pressure, but rather to reduce it. If this is the case, these baths should also be beneficial in contracted kidney. The baths of Nauheim have the effect of reducing the blood pressure for a longer period than the artificial baths. The more carbonic acid the bath contains, the more the temperature may be lowered, but not below 90° F. The baths seem to dilate the peripheral vessels, a condition brought about by the irritation of the gas and the reduction of the blood pressure; they lighten the work of the heart and lead to a saving of that organ, which gives it a chance of recovering strength, and this is still further promoted by the direct stimulating and tonic effect of these baths. The increase in the diuresis is ascribed to the strengthening of the heart.\*

Lydston believes that decomposition of the gastro-intestinal juices, and gastromotor insufficiency may be produced by the ingestion of water in large quantities.

Edema and anasarca, while often relieved by the free in-

gestion of water under favorable circumstances, are not infrequently enhanced by it.

Renal water habit may develop, by virtue of which the kidney becomes permanently sluggish, unless it receives its wonted stimulus of large quantities of water.

Acute and chronic inflammatory affections of the kidney are sometimes aggravated by giving water in excess, simply by overworking the renal organs.

Inflammatory affections of the lower portion of the genito-urinary tract are often deleteriously affected by excessive water-drinking, through the mechanical disturbances necessitated by the resultant frequent and copious micturition.<sup>9</sup>

**Myelopathic Albumosuria.**—This rare condition has been observed in about twenty cases. It occurs in the second half of life, from the age of thirty-six to seventy-one. The proportion, according to sex, has been three in men to one in women. The disease manifests itself in two ways, first, by an invasion of certain bones by a soft mass of new growth, and second, by the appearance in the urine of albumoses. The bones most often affected are the ribs, sternum and vertebral bodies. The new growth has a general resemblance to red marrow. The cold nitric acid test shows proteid in the urine, but the coagulum disappears on boiling. The cases terminate fatally, as in malignant disease.

**Chronic Nephritis and Senile Pneumonia.**—The writer has seen several cases in which examination of the urine revealed albumin and tube-casts in such numbers as to suggest that the case was one of chronic nephritis, while the other clinical features were those of pneumonia. The cases of this character occur in the elderly. Some care is necessary in making a diagnosis under such circumstances.

A striking feature of pneumonia, even in the early stages, before the diagnosis can be made with certainty is sometimes a marked increase in the amount of *urea* and *total solids* in the urine per twenty-four hours. When the patient is in bed,

and on restricted diet, this increase is all the more significant. In one case the writer found more than six hundred grains of urea in the twenty-four hours' urine, one day before the diagnosis could be made with certainty. During convalescence the urea and total solids diminished to the normal figures. The same increase, however, is not noticed with reference to the *chlorides*, which progressively diminish until at the height of the disease they may be entirely absent.

In all cases of pneumonia the excretion of chlorides should be carefully watched. Obtain a Purdy percentage tube, graduated, and holding fifteen cubic centimeters, one-half a fluidounce. Fill it, every day, up to the mark 10 C.c. with filtered urine, add twenty-five drops of strong, pure, nitric acid, and fill up to the mark 15 C.c. with a solution of silver nitrate, containing one part, by weight, of the crystals, dissolved in eight parts, by weight, of distilled water. Mix well and the dense white precipitate obtained may be allowed to settle of itself, which it will do in a few hours, or it may be settled in three minutes by use of the centrifuge. In either event the bulk of the precipitate can be measured. As long as the bulk of the precipitate shows *diminution* from day to day the patient is getting worse. When there is less than half of one cubic centimeter of it the disease is approaching the crisis, at which time there may be only one or two-tenths of a cubic centimeter, or, even no precipitate at all. When the precipitate begins to *increase* again, the patient is improving. Normally, there should be about one cubic centimeter of precipitate, or ten per cent. of the bulk of the whole fluid. If the urine contains albumin, remove it by boiling and filtration.

In senile pneumonia, where the only symptoms may be weakness, a rise in temperature and increase in the number of respirations, the writer has, in several cases, as stated above, found a little *albumin* and *numerous tube-casts* in the urine. The casts have been always hyaline or granular. In

one case an unusually large number of hyaline casts was noticed and but few granular; in another case numerous granular and but few hyaline. It is difficult to say whether these features in the urine were those of a previously existing chronic interstitial nephritis or not, as the previous history of the cases was not known to the writer. No œdema, however, was present in either of them.

**Ocular Manifestations of Chronic Bright's Disease.**—The ocular lesions which may be seen associated with chronic nephritis are classified by Dr. G. M. de Schweinitz, as follows:

1. Complete blindness, without ophthalmoscopic lesion. This occurs most often in acute nephritis, but also in acute exacerbations of chronic nephritis.

2. Albuminuric retinitis and neuro-retinitis. Death usually within two years.

3. Alterations in the caliber and relation of the retinal vessels, owing to sclerotic changes in their walls, with or without haemorrhages and exudates in the retina, seen in association with those forms of renal disease in which vascular changes are evident elsewhere in the body; also isolated haemorrhages and exudates without marked vessel-wall changes.

4. Alterations in the focal tract, particularly in the choroid and iris. The choroidal lesions are not evident to the ophthalmoscope, but can be seen only on microscopic examination.

5. Some varieties of cataract. A causal relation between nephritis and cataract has, however, never been established.

6. Paresis and paralysis of the ocular muscles, particularly the superior oblique and the external rectus. They are rare, and may be terminal symptoms of albuminuria.

7. Recurring subconjunctival haemorrhages. This manifestation has not received the attention it deserves among the ocular signs of nephritis. In five cases three died within three years.

The haemorrhages occur in persons past forty, and usually during sleep, the patients being surprised on waking to find an extravasation into the conjunctiva. An exactly analogous condition may appear in the delicate skin of the lower lid.—*Proceedings of the Philadelphia Medical Society.*<sup>4</sup>

**Theocin as a Diuretic.**—Theocin is the name given to theophyllin prepared synthetically. (Theophyllin is a compound, isomeric with theobromine and paraxanthin, and formerly made from tea extract at great cost.) The dose of Theocin is 0.3 to 0.5 grammes ( $4\frac{1}{2}$  to  $7\frac{1}{2}$  grains) best administered dissolved in warm tea. Minkowski has used it in fourteen cases of dropsy from various causes, and its diuretic effect was manifested in all but two, in which vomiting always occurred after its administration. Increase in the quantity of urine up to 3,000 to 5,000 c.c. was obtained. Its effect was not very lasting in some cases.

Minkowski finds that it acts more powerfully and promptly than Theobromine, and in smaller doses.

**Turpentine in Flaxseed Poultices as a Diuretic.**—In a case of chronic nephritis, in which the urine was examined by the author, Muhlenberg, of Reading, Pa., made use of the following: Two teaspoonfuls of turpentine were stirred up in a flaxseed poultice and applied to the region of the kidneys. Clevenger, of Chicago, subsequently confirmed the efficacy of this treatment in the same case.

**Primary Chronic Interstitial Nephritis in Children.**—Medical literature of the last five years has recorded several hundred cases of this disease in children between the ages of five and fourteen years. There have also been a few congenital cases reported. Baginsky has noticed a lack of development in children suffering from this disease; children twelve or fourteen years of age may show a development equal only to that of half of these ages. The prognosis is very unfavorable. The disease lasts from two to four years in most cases and usually terminates in cerebral haemorrhage. Complete rest

in bed with gentle massage once daily, milk diet in the main, and plenty of water to drink are valuable in the treatment, which medicinally is the same as in the case of adults and which, as in adults, is chiefly for controlling the more distressing symptoms. M. E. Douglass advises digitalis tincture in cases of suppression of urine in chronic nephritis.

**Paroxysmal Hæmoglobinuria in Children.**—Herrman reports a case in a child which had hereditary syphilis. The urinary findings were similar to those in the case reported by the author due to scurvy from use of artificial foods. Herrman's treatment was by Protiodide of Mercury and Peptonate of Iron.

**Pyonephrosis in Pregnancy.**—Cumston, in the *New York Medical Journal*, describes a case of pregnancy complicated by pyonephrosis. Nephrotomy was first performed, but septic symptoms set in twelve days after operation and nephrectomy had to be performed. Recovery took place and the patient went to full term and was delivered without trouble.

## RENAL CALCULUS. LITHÆMIA.

*Calculous anuria* has been studied by various writers. In fifty-six cases which were not operated on, sixteen went on to recovery, while the other forty died, principally within a week. Of the fatal forty, ten were not examined after death; of the others, twenty-three presented recent obliteration of one ureter, and seven showed one or more calculi in the pelvis capable of completely blocking the opening of the ureter. On the opposite side three kidneys were congenitally absent; six showed atrophy or some other change due to calculi; fourteen, various calculous lesions; six, obliteration of the ureter, and one a healthy kidney. From these cases it is possible to claim that anuria is not necessarily due to obliteration of the ureter, but that it may come from unfixed calculi in the pelvis of the kidney, without these causing absolute clos-

ure of the ureter. Generally the opposite kidney is affected, although, in spite of the condition, it is, in a certain proportion of cases, capable of carrying on the function. Comparing the results of non-interference (a mortality of 71.5 per cent.) with those of surgical interference (eleven cures out of sixteen cases—66.6 per cent.), the value of surgical treatment is at once apparent; in the operation the position of the calculus must determine the details and the exact character of the procedure. Lumbar incision is generally the best, but the final decision of method must consider the question of ureterotomy simply, and the creation of a urinary fistula in the lumbar region.<sup>6</sup>

**Suppression of Urine from Renal Calculi.**—A case is reported by Driggs in which total suppression of urine lasting fifteen days was due to impaction of both kidneys with calculi.

**Diagnosis of Renal Calculus.**—Bennett does not seem to look with great confidence upon skiagraphs as an aid to diagnosis, in this respect differing from a number of authorities. He claims that the negative result of the X-ray examination is "practically valueless." Leonard (*Jour. A. M. A.*, November 30, 1901) makes the most positive claim for the value of negative as well as positive results with the X-ray in cases of suspected renal and ureteral stone, and asserts that incision into the kidney for suspected calculus is only justified by the previous detection of the stone by the Röntgen method. Jonathan Hutchinson, Jr. (*Brit. Med. Jour.*, October, 1901) also expresses great confidence in the X-ray method, excepting in cases in which the patient is very fat and the stone very small. Bevan (*Annals of Surgery*, March, 1901) says that the X-ray has revolutionized the diagnosis of renal stone and his experience regarding the value of this method corresponds to that of Leonard, who is probably its strongest advocate. He presents a skiograph which shows a stone in the kidney which failed to be located during an exploratory incision of the kidney. He also tells us of cases in which multiple stones

have been demonstrated by the X-ray and yet the surgeon would probably have been contented with the removal of the largest of these.<sup>8</sup>

**Passage of a Renal Papilla.**—Smith has detailed an instructive case as follows: "A plethoric man, of 45 years of age, who, after several weeks' illness with symptoms of hepatic disturbance, was taken seriously ill and went to bed, where he remained for a number of weeks with symptoms precisely those of acute Bright's disease. Fever ran high, the urine was scanty, high colored and smoky, containing casts of blood and granular matter. Examining the patient about a week after this second attack, a tender point was found over the left kidney upon deep abdominal palpation. This was supposed to be due to a pyelonephritis, probably from the presence of a calculus, and the other symptoms were referred to a similar cause. The symptoms gradually diminished, the albumin left the urine and the patient was apparently convalescent from the attack, when an exacerbation occurred two weeks after the beginning of this second attack; recrudescence of symptoms again occurred in two weeks, and in six weeks after this last. Finally, the patient handed his physician a small bit of tissue which he had passed with a considerable pain, by the urethra, two days after the final exacerbation of his symptoms. During this period of exacerbation the symptoms were those of renal colic, affecting the left side. After the passage of the tissue the patient rapidly recovered and resumed his business. Microscopical examination confirmed this to be a renal papilla."<sup>6</sup>

**Ureteritis in the Female.**—Garceau (*Am. Jour. of the Med. Sci., Feb., 1893*) classifies ureteritis as follows: (1) Simple ureteritis. (2) Ureteritis with obstruction. (3) Tubercular ureteritis. In simple ureteritis, using Kelly's cystoscope, he collects the urine from the ureters without admixture from vesical elements. He finds an excess of desquamated epithelium with or without pus in the urine from the affected side.

Also diminution in the amount of urea in the urine from the affected side.

A vaginally tender ureter is an important clinical sign. In treatment, a bland nutritious diet, avoiding asparagus and rhubarb, attention to the bowels and skin, and avoidance of fatigue are important. Patients should lead regular lives and have fresh air. Among drugs, bicarbonate of soda is valuable, and tonics. Alcohol and Morphine should be avoided. Trional in one or two ten-grain doses is best for sleeplessness. Relief is had from topical applications to the bladder (nitrate of silver, 5 or 10 per cent., and boric acid, 2 per cent.) or nitrate of silver, 1 per cent., in topical applications to the ureter by means of a new apparatus devised by Garceau.

Vesico-vaginal fistula will somewhat relieve cases in which there is also well-marked cystitis.

In ureteritis with obstruction there is either partial or complete obstruction. The chief cause of fibrous stricture is gonorrhœa. The symptoms are those of simple ureteritis and the chief distress is "a nagging desire to urinate." The diagnosis is made with ureteral bougies. Dilatation of the stricture relieves the symptoms. If gradual dilatation fails, the ureter is to be exposed through an extra-peritoneal incision, after preliminary introduction of a ureteral catheter, and the stricture cut.

The diagnosis of ureteral calculus may be made from the history, the finding of blood in the urine from the affected side, lessened urea excretion on the affected side, feeling of the stone, if possible, by the finger in the vagina, use of the X-ray, and wax-tipped bougie. When the obstruction has existed for an appreciable length of time, the stone should be removed by extra-peritoneal operation.

In complete obstruction of the ureter there may be agonizing pain on urinating or none at all. Acute attacks of pain in the kidney may be present, with fever, sweat, and gastric symptoms. Bi-manual examination of the bladder sometimes elicits pain.

Pressure in the hypochondrium just below the ribs in the renal region generally evokes resistance of the abdominal muscles, a valuable sign of inflammatory renal disease. On the affected side pyuria is marked. The pus may have a fetid odor, albumin is present in large amount and the specific gravity of the urine is low. Difficulty is encountered in passing the stricture with even a small-sized ureteral catheter. When the stricture is once passed, a gush of accumulated urine and pus establishes the diagnosis.

Four courses are open for consideration in the treatment of fibrous stricture with pyelonephritis and violent cystitis : The first is nephrectomy ; the second is gradual dilatation of the stricture with bougies, combined with repeated washings of the renal pelvis with antiseptic solutions carried up to the kidney by means of a long renal catheter ; the third is the performance of a cystotomy, with the idea of relieving the distressing symptoms on the part of the bladder and of allowing the kidney to go on to complete destruction, in the hope that it will atrophy and give rise to no further disturbance ; the fourth is making an artificial fistula above the strictured portion of the ureter.

If it is tolerably certain that the kidney has ceased to be actively functionating, as determined by the examination of the separated urines, the methylene blue test, and by cryoscopy, and it is fairly certain that it is not worth saving, the idea of nephrectomy may be entertained. Nephrectomy may sometimes become imperative, as, for instance, when a general infection of the body threatens. Perinephritic abscess sometimes supervenes in these cases of pyonephrosis ; and if the symptoms incident to such a complication are marked, as they are quite certain to be, the safest treatment is preliminary incision and evacuation of the pus, and secondary nephrectomy later, when the patient has recuperated from the acute septic condition.

The treatment of pyonephrosis associated with stricture by

means of dilatation of the stricture, combined with repeated washings of the renal pelvis with antiseptic solutions, has much to recommend it, and it is especially to be considered in those cases of pyonephrosis which have not yet been of sufficiently long duration to have destroyed a very large portion of the renal parenchyma. The method consists in passing the renal catheter up to the renal pelvis through the stricture, which is at the same time dilated ; antiseptic solutions are then allowed to flow through the catheter, and local treatment is thus given every few days.

It will sometimes happen that the patient will not entertain the thought of nephrectomy. In such a case it is essential to do something to relieve the distressing symptoms on the part of the bladder ; but if the kidney is the source of considerable disturbance from the accumulation of purulent urine within it, simple cystotomy will not give much relief, except in so far as it relieves the vesical symptoms. With a "silent" kidney, however, cystotomy will at once put the patient in a condition of comparative comfort, and she enjoys life once more. It is possible at the end of many months that the kidney process may come to an end, and the final stage of inspissation and atrophy takes place. It is conceivable under such circumstances that the patient might get entirely rid of her infection and recover, in which case the fistula might be closed.

A fistula above the stricture may sometimes have to be made if for any reason nephrectomy or other methods of treatment are impracticable. The indications are distressing focal symptoms on the part of a kidney. The fistula may be made into the vagina, provided the stricture is low enough, or it may be made into the loin if the stricture is a high one. Subsequent nephrectomy should be entertained if this operation is practicable, depending on the decision of the patient and her general condition.

Calculus in the ureter causing complete obstruction is

recognized by history and symptoms of stone in the kidney preceding. The urine in complete obstruction will not flow on the affected side. Periodical discharges of pus point to intermittent complete closure.

The diagnosis is made by a careful survey of the previous history of the case. Previous attacks of haematuria are of great diagnostic value, as are also attacks of colic. The X-ray should always be used to determine the seat of the stone; it will not always be successful in locating it. If an exploratory incision is made into the kidney the diagnosis of ureteral obstruction may be made by passing a sound into the ureter from above, but the same result is arrived at by ureteral catheterization through the vesical route. If the latter is done the nature of the obstruction cannot, however, be accurately determined. Vaginal touch will sometimes locate a stone, which may be felt as a hard mass under the examining finger.

The treatment of complete obstruction is surgical. As to the kind of operation selected, this will depend on the condition of the kidney and the length of time that impaction has existed. It is not proposed to discuss the various methods in detail.

In tubercular ureteritis thickening of the ureter, found by vaginal examination, is quite characteristic. The ureter is felt as a solid cord running toward the pelvic brim. It is very tender, and pressure excites an urgent desire to urinate. Additional evidence is furnished by the history of the case, the cystoscopic appearances and focal symptoms on the part of the kidney. Finding of the bacilli in the urine confirms the diagnosis. Total nephro-ureterectomy should be done in all cases in which the condition of the patient warrants it.

**"Uric Acid Diathesis."**—Dr. Charles Platt, in discussing a paper on lithæmia, by Dr. Norton, states as his own belief that normally in mammals uric acid has a common origin with the nuclein bases in the catabolism of the nucleo-proteids that is not derived from the nuclein bases, neither from those

of the body nor from those of the food ; that a certain small percentage in health and a larger percentage in disease—in disturbed hepatic metabolism—arises from glycocol, leucin, asparaginic acid, etc., which reach the liver *via* the portal tract.

The term lithæmia is a poor name for a condition of toxæmia, a poisoning of the sympathetic ganglia, a poisoning generally of intestinal origin.

**The Meaning of Uric Acid and Urates.**—A notable view is the recent one of Woods-Hutchinson (*Lancet*, January 31, 1903).

The uric acid produced in health comes exclusively from two sources, the larger moiety, or exogenous uric acid of Chittenden, from the nucleins and purin bases of the food, the smaller or endogenous moiety, from the destructive metabolism of the nucleins of the body-tissues.

It is the *endogenous moiety alone* which is increased in gout and lithæmia.

Gout and lithæmia are mere symptom names for a miscellaneous group of chronic toxæmic processes of widely varied origin, characterized by the production of uric acid and urates.

The uric acid of gout, like the phosphoric acid which invariably accompanies it, is merely a result and measure of the destructive metabolism of the nucleins of the body-cells, chiefly probably of leucocytes, in response to the invasion of poisons or toxins, either organic or inorganic (lead, phosphorus, alcohol, acetone).

As most of the toxins setting up this destructive metabolism and consequent uric acid production are of intestinal origin or entry, *diet in gout should be regulated solely with regard to the diminution of intestinal fermentation and putrefaction.*

As animal foods, from their much more appetizing and attractive flavors, are more apt to be indulged in in excess of

the oxidative powers of the body, their limitation may be found to be more necessary than that of vegetable foods, but sugars and starches are also very often at fault.

As uric acid and the alloxur group are not toxic, or at best feebly so, and are not the cause of gout, the prohibition of even foods rich in nucleins and purin bases, such as red meats, roe and sweetbreads, has no rational basis, and is clinically of doubtful utility, except by diminishing the attractiveness of the dietary.

**Sidonal in "Uric Acid Diathesis."**—Freeman F. Ward, of New York, has used Sidonal extensively in the treatment of uric acid diathesis. Fifteen-grain doses in one-half glass of water one or two hours before meals were administered with benefit in cases where an excess of uric acid was found in the urine. In cases where very little or no uric acid was found the drug was of no avail, although it did no harm.

"New Sidonal" (quinic acid anhydrid) has been given by Huber and Lichtenstein to gouty patients with benefit in daily doses of  $2\frac{1}{2}$  grammes.

Weiss, of Basel, and Neumann, of Munich, use Quinic acid in combination with Lithium citrate in a preparation known as Urosine; dose, six to ten tablets daily. Each tablet contains 0.5 gm. Quinic acid, 0.15 gm. Lithium citrate and 0.3 gm. sugar.

**Walker Hall's Purinometer.**—Hall's method is based upon Camerer's method for the estimation of the total purin bodies in the urine. The urine is first freed from albumin. The phosphates are then precipitated by solution No. 1, which consists of

Ludwig's magnesium mixture, . . . . .	100 c.c.
Ammonia (20 per cent.), . . . . .	100 c.c.
Talc, . . . . .	10 grammes.

After precipitation the phosphates are separated by turning a tap in the apparatus. The purin bodies are then precipitated by No. 2 solution, which consists of

Silver nitrate, . . . . .	1 gramme.
Ammonia (strong), . . . . .	100 c.c.
Talc., . . . . .	5 grammes.
Distilled water, . . . . .	100 c.c.

In an hour an approximate idea of the result can be obtained, and twenty-four hours later the precipitate can be read off on the graduated glass. Each cubic centimeter of the precipitate represents 0.0010 nitrogen.

#### URO-GENITAL TUBERCULOSIS.

Frisch states that the discovery of bacilli in the urine is apt to be attended with difficulty both from the scarcity and the massive numbers to be encountered in different (or even in the same) specimens, at different examinations. One occurrence of the bacilli, that in which they are arranged in S-shape groups, is especially valuable as a diagnostic sign of a urinary tuberculosis, but it is possible that even in such groups the tubercle bacilli may find their way into the urine from more distant tubercular foci. Nevertheless, these groups are more apt to come from masses of bacteria in close contact with the urine stream. Where the urine contains large quantities of mucus he suggests that it be treated with an alkali to dissolve the latter, thus permitting the precipitation of the bacilli. Where the sediment is largely made up of urates and other crystalline substances, he uses, after Wendriner, a solution made of hot distilled water, in which is dissolved twelve per cent. of powdered borax, and afterward an equal amount of boracic acid added. This added to the urine dissolves the uric acid, urates, earthy phosphates and other organized substances. The urine is permitted to stand until the sediment is deposited, then the supernatant fluid is poured off, the sediment washed with water and collected upon a filter, and a portion of this pressed (but not rubbed) between two covers, dried and stained.<sup>6</sup>

Garceau concludes from a study of a large number of cases

that a patient who has been nephrectomized for tuberculosis should never consider that his future is safe, but should take the utmost care of himself. Out of 415 cases studied by Garneau, 275 occurred between the ages of twenty and forty. Miliary tuberculosis is by far more common than caseous. It is quite possible for an obsolete tubercular process in some other part of the body to give rise to renal tuberculosis. Infection through the urethra is not common.

There is no question but that vesical tuberculosis as a primary disease is more common in males than in females, and it would appear also that the kidney is oftener affected primarily in males.<sup>10</sup>

## TUBERCULOUS CYSTITIS.

Tuberculous disease of the bladder is rarely primary, being generally secondary to a tuberculous condition of the prostate or kidney. Hæmaturia is the most frequent and probably the earliest symptom of the disease, so early in some instances that it may be called a prodromal symptom. It usually occurs at the end of urination, and varies in amount from a couple of drops to a teaspoonful. Pain is frequently present, commencing early and continuing through the course of the disease. At times it is so severe as to make one suspect calculus or malignant ulceration. Tenesmus is usually present. Frequency of urination is a fairly constant symptom, coming on early in some cases. As the disease progresses the symptoms increase. Later pus is always found. The frequent voidance of clear urine without pain, with a few drops of bright red blood at the end of the urination, or less often preceding it, is almost pathognomonic of beginning tuberculous cystitis. The pulse is quite suggestive, averaging from 90 to 110, any sudden exertion increasing it to a considerable extent. At present, Bissell (*Phila. Med. Jour.*) believes that the best chance of recovery is in eliminating the cause and building up the resisting powers of the tissues of the body.<sup>2</sup>

**Ureteral Catheterism and Cystoscopy.**—Guiteras, in an address delivered at the annual meeting of the American Urological Association for 1902, says: "But few surgeons can be relied on to catheterize the ureters successfully." He thinks, however, that there is no doubt that the procedure is of great value in cases of renal diseases marked by morbid processes in the bladder, in cases of doubt as to the functional activity of the opposite kidney, and in furnishing a guide to the ureter, preventing its injury and securing drainage from below in renal operations. He takes exception to the advice of Edebohls, who prefers bilateral lumbar incision to ureteral catheterism, on the ground that even if the kidney on the opposite side is found to be present, it is by no means certain, by palpation of it, to determine whether it is normal or nephritic, or whether small stones or suppuration are present in it. Guiteras thinks also that the limitations of the Harris segregator are obvious. In fungous growths of the bladder and in other conditions of this viscus, which are accompanied by an easily bleeding surface; in cases of deformed or contracted bladder, vesical calculus and hypertrophied prostate it cannot be expected to give accurate results; while valuable in certain cases it cannot supplant ureteral catheterism.

In connection with this subject the author wishes to emphasize the statement already made in the body of this book, that tube-casts in number may sometimes be found in the urine after washing out the diseased bladder, the detection of which is impossible before this simple means has been adopted for finding them.

According to Guiteras those who have special training and skill in cystoscopy do not now hesitate to operate by the aid of vision by means of the operating cystoscope perfected by Nitze, whereby cauterization, removal of growths, etc., in the bladder are made possible under the surgeon's eye without opening the organ.

**Vesical Spasm with Retention of Urine.**—For the relief of

vesical spasm, with retention of urine, after the failure at catheterization and a sitz-bath, Mesnard gave 1 granule each of Bromhydrate of Cicutine and Hyoscyamine, every quarter of an hour. After an hour's use of these remedies, the patient, an old man, aged sixty-seven years, passed urine freely. Next day he complained of incontinence, and the Hyoscyamine was replaced by Sulphate of Strychnine, 1 granule every hour. He was eventually restored to health. On the other hand, Irwin overcame spasm with retention, in a boy, by urethral injection of Cocaine in 4 per cent. solution. In the case of a young man with a primary attack of gonorrhœa there occurred four days after the onset complete retention; catheterization was easily practiced, but the retention continued unchanged after the withdrawal of the urine. The man had no desire to urinate, and yet there was not the least obstruction to the passage of the catheter. Rochet in this case administered Ergot and electrical stimulation in the hypogastric region, with the result of quickly overcoming the symptom. A paralysis of the walls of the bladder from the intensity of the primary affection was probably the cause.<sup>6</sup>

**Cystalgia.**—This term is applied by certain French writers to a new variety of cystitis without peculiar anatomical features, but marked by excessive and intense pain, long duration, continued manifestation of symptoms without any long remission and entirely unrelieved by the ordinary therapeutic measures. It occurs, especially in women with tubercular cystitis, following an overdistention of the bladder in lavage or careless use of vesical instruments. Frequence of micturition and pain are the two symptoms, which, from their importance and tenacity, distinguish this variety from other vesical inflammations. In a case of Marieux's the patient urinated 120 times in the twenty-four hours; the totality of urine is, however, but little increased. The pain is deep-seated, ill-defined, usually referred by the patient to the lower part of the bladder, rarely to the prostate gland, the base of the penis, the perineum, or the anus.<sup>6</sup>

Lydston says that neuralgia of the bladder is a very important point for consideration, because of (1) the relative importance of pain, *per se*, in diseases of the bladder; (2) the fact that very often no lesions are discoverable which explain the pain, or, at least, such lesions as are found appear too trivial to explain the severity of the pain experienced by the patient; (3) the tendency to too radical treatment in the endeavor to relieve pain, by compelling a cure of lesions which are so slight that topical applications are likely to do harm rather than good. Cystalgia may occur with lesions of the genito-urinary apparatus, *i. e.*, lesions affecting the urethra, bladder, kidneys, testis and spermatic cord; with lesions of neighboring organs, such as the prostate, rectum and anus. It may be incidental to ataxia or general paralysis, and be associated with gout, rheumatism, lead poisoning and malarial infection. There exists also an essential cystalgia. In the diagnosis the surgeon should be guided largely by the character and severity of any primary pathological condition that may be present, of an inflammatory infectious character. He should also take into consideration the patient's general state. Care should be taken not to treat too radically lesions of the urinary way, the mildness of which is out of all proportion to the severity of the neuralgic manifestation. Narcotics, per os, hypodermically or per rectum; hot applications to the hypogastrium, instillations of very weak cocaine or menthol solutions into the deep urethra or vesical neck are generally useful, but the constitutional treatment is by far the most important.<sup>2</sup>

**Cystitis in Typhoid Fever.**—Two distinct classes of cystitis are recognized by Biss in typhoid fever—those in which it is directly caused by retention, and perhaps by unclean catheterization, which cases may or may not be specific, and those, on the other hand, which are spontaneous in origin and certainly specific. Concerning frequency, the medium and severe cases seem to suffer most often; the sexes are affected equally, and no differences are noted as to age. The average

date of the appearance of bacilluria is the forty-third day ; of cystitis, the thirty-sixth. None of the theories which seek to account for a pathological basis are quite convincing, but it seems most likely that a multiplication of the bacilli takes place in the bladder. Sometimes not the typhoid, but the colon and other bacteria, are the cause of the cystitis. Concerning treatment, Urotropin should be given as early as possible without waiting to diagnose the bacillus. Of this, 20 grains may safely be given every four hours, and the administration should not be stopped too soon. Some forestall the appearance of a cystitis by giving the drug throughout the disease.<sup>15</sup>

**Cystitis in La Grippe.**—Breton (*Gazette des Hôpitaux*) reports three cases in women of hemorrhagic cystitis in grip. Rest, milk diet, emollient drinks, hot vaginal douches, suppositories of Opium and Belladonna; internally, Turpentine and Benzoate of soda were the treatment.

**Treatment of Cystitis.**—C. N. Cooper, of Cincinnati, uses *Populus tremuloides* (American aspen) in five drop doses of the first decimal every three hours for moderate cases, especially in old men with enlarged prostate. He also recommends *Pareira brava* and *Hedeoma* (Squaw-mint). In chronic cases, Boracic acid in from ten to twenty grain doses for sterilizing the urine.

Cooper says: "In acute cystitis hot body-baths are of value. Also, hot-water injections into the rectum as well as Opium suppositories.

For the bladder cleansing, Borolyptol, Glyco-thymoline, Boracic acid (three per cent.), Potassium permanganate (two per cent.) are in daily use ; recently I have been more than pleased with the Borolyptol.

Protargol, the Silver nitrate solution, is highly recommended ; personally, I have seen no good results, and doubt its medicinal value.

Electrozone, or, so-called electrolocyzed sea-water, I have

seen the best results from ; but with the caution of making sure it is a stable product. My experience is, it varies in strength ; recently having used one package with good effect, the second bottle setting free chlorine in excess, so as to require prompt and liberal use of Albumen to antidote its ravages.

Any wash, as a cleanser, should be introduced only after the bladder is emptied of urine, and then in measured quantities, varying as to the size of the bladder ; this application allowed to remain a few moments and again repeated, until the last withdrawn fluid is as clear as on introduction. In paretic cases, care must be taken to get back all the fluids used, in order to know in what condition, as to contents, the bladder is left.

For healing or soothing purposes after cleansing, use a wash of one ounce of Fluid hydrastis, one ounce of Borolyp-tol, one ounce of Glycerine to a pint of warm water, adding Hamamelis one ounce, or Turpentine ten drops, as is best indicated, if there is tendency to bleeding. Many times from the excessive decomposition and accumulation of pus, blood, etc., we may fail to have its discharge by the catheter ; when fifteen to twenty grains of Pepsin dissolved in water, and thrown into the bladder, and allowed to remain one hour or less, will relieve the trouble.

In prostatic complications a four per cent. Cocaine and Lanoline application to the gland, per rectum, will afford relief in many cases. Whatever solutions are used, the temperature should be about one hundred degrees when reaching the bladder, and not more than two ounces at one injection for the first sitting, or until the bladder grows more accustomed to larger quantities.

The patient's position should be standing, if possible, that the drainage may be complete ; otherwise he should remain quiet, in bed, with the hips slightly elevated, that the bladder neck may be the least irritated." <sup>15</sup>

The author's attention has been called by Dr. C. S. Elbridge, of Chicago, to the efficacy of a preparation known as *Methyloids* in the treatment of cystitis. In a severe chronic case in a woman which had long resisted treatment by a number of agents, substantial and continued improvement followed the use of Methyloids, at first given two or three per twenty-four hours and subsequently one a day. Methyloids contain Methylene blue, Copaiba, Sandalwood oil, Haarlem oil and Cinnamon oil. E. G. Davis recommends Uriseptin.

**Adrenalin in Cystitis, Urethritis and Vaginitis.**—In inflammations of the bladder the organ is first washed out in the usual manner, and a mixture of solution Adrenalin chloride, four fluidrachms, and normal saline solution, thirty-six fluidrachms, is introduced and allowed to remain for five minutes. In inflammations of the deep urethra a few drops of the 1:1000 solution may be introduced through a catheter. The passage of the sound or catheter in urethral stricture is facilitated by allowing a few drops of the 1:1000 solution of Adrenalin chloride to trickle through the instrument and come in contact with the obstruction. Inflammations of the vagina are most economically treated by mopping the vaginal walls with the cotton swab moistened with the 1:1000 solution.

**Adrenalin in Hæmaturia.**—In a case of slow oozing of blood from the bladder-walls Chassaignac used Adrenalin as follows: "I prepared a solution of Adrenalin chloride of 1:20,000 by diluting the 1:1000 solution with normal salt solution. After rinsing out the bladder with Boric solution the organ was moderately filled with the Adrenalin solution, which was retained for five minutes and then permitted to escape. The effect was all that could be expected. The patient voided clear urine from this time until after midnight, when a pink tinge appeared and slowly deepened. In the morning the operation was repeated with a 1:24,000 solution. Again the urine became clear, and remained so all day and night. I

made one more irrigation with a 1:30,000 solution. The patient was warned of the risk of allowing his bladder to become distended, and was permitted to go home.”<sup>16</sup>

J. S. Steiner, M. D., Bluffton, Ohio, writes that he with another physician tried for hours to pass a catheter into the bladder of a patient suffering with distention due to an enlarged prostate. Finally a hard-rubber catheter with a small fenestrum was chosen, and a syringe attached to the end of it. The catheter was introduced into the urethra, and by means of the syringe the solution of Adrenalin chloride was forced down against the resistant tissue. Owing to the powerful astringent effect of the Adrenalin, the caliber of the urethra was enlarged, and the catheter was passed into the bladder in less than five minutes.

In operating on tumors of the bladder, and in performing supra-pubic cystotomy, Professor A. Von Frisch, of Vienna (*Wiener Klinische Wochenschrift*, No. 31), after opening the bladder, makes several applications of Adrenalin solution, 1:1000, to the tumor and its immediate neighborhood, using a cotton pledge for the purpose. He states that this suffices perfectly to render possible the extirpation of the tumor in the blanched tissue, almost without any loss of blood whatever.

At a recent meeting of the Southern Branch of the British Medical Association (*British Medical Journal*, May 31, 1902), Mr. Rundle reported the case of a man suffering from severe haematuria, probably prostatic in origin. Various astringents had been tried without relief. After three injections of Adrenalin chloride solution the urine became clear and continued so. Mr. Rundle considers Adrenalin worthy of further trial in similar cases. Dr. C. Knott had written concerning this treatment, and instanced a case recently under his care which was benefited thereby.

Professor A. Von Frisch, of Vienna (*Wiener Klinische Wochenschrift*, No. 31), observes that in cystoscopic examinations in cases of vesical haematuria the preliminary irrigations

always cause a renewal of the hæmaturia, which interferes with examination. In such cases he fills the bladder with a solution of Adrenalin chloride 1:10,000, leaving the liquid in the viscus three to four minutes, after which the preliminary irrigations are begun. Thus he avoids all haemorrhage, or it is so slight that the clearing up of the contents of the bladder is readily effected, and the cystoscopic examination can be completed with perfect success.

**Helmitol as a Urinary Antiseptic.**—Helmitol is a combination of anhydromethylene citric acid with hexamethylene tetramin. After ingestion it is decomposed into methylene citric acid, or a salt of it, and hexamethylene tetramin. A certain portion of the methylene citric acid is excreted as free formaldehyde.

The dose of Helmitol is from ten to twenty grains in water. It is said not to irritate the kidneys. Rosenthal has used it in acute gonorrhœal cystitis, and in a case of chronic cystitis in an old man with benefit.

**Urinary Incontinence in Women.**—A modified form of Brandt's treatment has cured urinary incontinence in women. The most essential part of this treatment is the direct treatment of the neck of the bladder by the finger in the rectum or the vagina. The following are the complete steps in this method of Brandt :

1. Tapotement of the lumbar and sacral regions. The patient stands with the feet together, bending slightly forward and supporting herself against a wall or some other firm object with her outstretched hands. A rapid, springy percussion is then made with the closed fist down both sides of the spine, beginning at the lumbar region and passing downward over the buttocks, after which the open hand is stroked firmly downward in the same direction several times.

2. The patient in dorsal position on a low couch as for vaginal examination, the operator in front of the patient, right foot on the ground, left knee on the couch, then bends

over the patient, extends his arms and lays his arms, ulnar surfaces approximated and finger-tips toward the pubes, on the woman's abdomen, in the hypogastrium. Sinking the fingers deeply into the abdomen as if to grasp the bladder, a hand on either side of it, a side-to-side motion is made with each hand several times.

3. The index finger of the left hand is introduced into the vagina in such a manner as to partly encircle the neck of the bladder, and the right hand grasps the left wrist so as to regulate more evenly the pressure. This done, the finger in the vagina is made to vibrate against the neck of the bladder, compressing it against the pubes with moderate force; the same is then done for the other side of the neck of the bladder. In children the finger is to be introduced into the rectum rather than into the vagina.

4. Exercise of the adductors of the thighs. The patient in same position places her knees and heels together and raises her pelvis off the table, supporting herself on heels and shoulders. The operator now draws the knees apart, the patient resisting, three or four times, then, the patient pressing against his hands, the operator forces the knees together several times.<sup>6</sup>

**Prostatic Hypertrophy.**—Summing up the points favorable to the three operative procedures especially considered in this discussion, Bransford Lewis says:

*Favorable for the supra-pubic route:*

1. General enlargement of the prostate, with extreme intra-vesical projection of the median or lateral lobes, diminishing their accessibility from the perineum.

2. Marked pedunculation of the intra-vesical tumors, with absence of obstruction from other sources.

*Favorable for the perineal route:*

1. General hypertrophy, involving the median and lateral lobes, without extreme intra-vesical projection.

2. Large or very thick bar formation; marked compression of the urethra between the enlarged lateral lobes.

3. Excessive development of the prostate in the direction of the rectum.

4. In most cases, where the patient is in good general condition and there is not a special indication favoring one of the other procedures.

*Favorable for the Bottini:*

1. Cases of extreme debility, unable to stand one of the severer operations.

2. Cases of bar or medium sessile obstruction of not too great dimensions.

3. Incomplete collar formation.

4. Horwitz says it should be employed as a prophylactic against further obstructive hypertrophy, at the beginning of catheter-life.

Supra-pubic cystotomy for drainage only is a palliative measure that has certain well-defined and highly advantageous features—not with reference to curing a case of prostatic obstruction, but for the purpose of improving conditions so that curative measures may be undertaken. It can be carried out under local (infiltration) anaesthesia, without adding to the seriousness of the conditions; and the drainage that it affords may work wonders in the manner mentioned.

As a substitute for this incision, being even milder still in its effects, Lewis commends a method as follows: Supra-pubic puncture with trocar and canula; withdrawal of the trocar; insertion of a soft-rubber catheter through the canula into the bladder; withdrawal of the canula, leaving the catheter retained in the bladder, and held in place by safety-pins and proper bandages. He drained one case for ten days in this manner and without ill effect.<sup>12</sup>

N. P. Dandridge (*N. Y. Med. Jour.*) urges that we should not be carried away by the operative furor of the present time, but we should remember that the older methods still possess a large field of usefulness. There are, indeed, many cases in which surgery alone will relieve the obstructed uri-

nary flow and cure the cystitis. In a certain number of cases complete relief will follow *simple perineal incision with drainage* for some weeks. It is in the large remainder that perineal prostatectomy promises a large field of usefulness.

P. J. Freyer has totally extirpated the prostate in twenty-one cases by a new supra-pubic method. Death took place in two cases, one from acute mania on the twenty-fourth day, and the other from syncope on the ninth day. R. Harrison has had good results in five out of seven cases.

Parker Syme believes in the perineal operation, and has removed twenty-one without accidents or death. He has devised a special instrument to render easy traction on the prostate during its removal.

#### URETHRITIS.

**Treatment by Argyrol.**—Argyrol is a silver vitellin produced from a protein derived by chemical manipulation of wheat, and subsequently combined with silver. The high percentage of silver in the compound, its extreme solubility, and its intense penetrating action on the tissues constitute its chief scientific points of interest. Argyrol contains thirty (30) per cent. of silver, which is more than three times the amount in Protargol, the best known of the newer silver salts. The solubility of Argyrol is quite remarkable, one ounce of it being completely soluble in a dessertspoonful of water, consequently the salt may be employed in solution in any desired strength.

H. M. Christian claims the following for Argyrol :

- (1) That it is absolutely free from any irritating properties, solutions as high as five per cent. causing no discomfort.
- (2) That the gonococci on and beneath the urethral mucous membrane are rapidly destroyed.
- (3) The amount of urethral discharge is, in a majority of cases, at once lessened in a marked degree.

(4) The actual duration of the disease is shorter than is obtained by the use of any other silver salt. Thirty-eight out of forty-eight cases were cured in from two to four weeks.

*Nargol* (nucleid of silver) is also used in the treatment by Baldwin, of Chicago.

**Bacteriuria.**—I. Rosqvist calls attention to the irregularity and changeability of the clinical symptoms from the presence of bacteria in the urine, and especially to the severity of the general condition. He recommends irrigations of the bladder with from one-half to four per cent. solutions of silver nitrate. Frank H. Pritchard finds the Salol and Copiba comp. formula of the New York Polyclinic, in capsuloids, efficacious.<sup>4</sup>

In one of the author's cases the patient claimed that the bacteriuria ceased after the drinking water used was boiled before taken.

**Epidural Injections for Incontinence of Urine.**—Cathelin has treated eleven cases of *incontinence of urine with epidural injections of salt solution* in doses of from five to fifteen c.c., until, in several cases, thirty-five to forty c.c. have been given. In other cases he employed a five per cent. solution of Cocaine hydrochlorate. None of the patients treated in this manner presented any accident beyond headache and nausea, except that in one instance the child vomited. The children were not kept in bed, but were treated in the dispensary of the Hospital Necker.<sup>13</sup>

**Diabetic Diet List.**—The following strict diet is recommended by N. S. Davis (*Jour. A. M. A.*): Breakfast—Tea or coffee without sugar or cream, one egg and bacon, and two or three slices of nut bread with butter. Dinner—Bouillon or broth; beef, mutton or chicken; spinach, asparagus or wax beans; salad of lettuce or tomatoes with cheese; black coffee without sugar. Supper—Tea or coffee without sugar or cream; meat, fish or mushrooms; a salad of tomatoes, lettuce or chicory; two or three slices of nut bread. At bedtime or in the evening an egg lemonade made with saccharin can be

given. Use as much butter as possible on bread and oil on salads; eat fat meats by preference.<sup>6</sup>

**Potatoes in Diabetes.**—Mosso uses a "potato cure" for the various forms of diabetes, substituting for bread 1 to 1.5 kilos (2.2 to 3.30 pounds avoirdupois) daily.

**Benzosol in Diabetes.**—J. B. White has observed benefit from the use of Benzosol in diabetes. A tablet of the following constituents is recommended:

Benzosol, . . . . .	1½ gr.
Lithium carb., . . . . .	1½ gr.
Sodium bicarb., . . . . .	1½ gr.
Potass. arsen. . . . .	½ gr.

**Eucalyptus Tea in Diabetes.**—Benefit has been reported from the use of a tea made from the leaves. The author used it in one case, but without the slightest apparent result.

**Aspirin in Diabetes Mellitus.**—Van Noorden has called attention to the value of Aspirin in the treatment of diabetes mellitus. Williamson, of London, the well-known authority on diabetes mellitus, has used Aspirin in four cases of this disease of the less severe form, with good results in reducing the amount of sugar. The dose is at first ten grains twice or three times daily, increased to fifteen, four or five times daily, if no noises in the ears or toxic symptoms occur. The drug may be administered in the form of a powder to be taken in a tablespoonful of water, to which one or two drops of lemon juice are added, or it may be given in rice-flour capsules, Konseals so-called.

Explicit instructions should always be given by the physician to dip the sealed Konseal in water. It should then be placed well back on the tongue when it will readily collapse, and with a swallow of any fluid, preferably water, or even without any, the pressure of the tongue will cause the mass to assume the same form as would a similar portion of food well masticated and mixed with the saliva, when it is pleasantly and easily swallowed.

[Physicians should see to it that their druggist is properly provided with the Konseal Apparatus for the filling and sealing of Konseals, which is furnished by the manufacturers, Messrs. J. M. Grosvenor & Company, Boston.]

**Supra-renal Extract in Diabetes.**—Dr. B. F. Bailey, of Lincoln, Nebraska, has successfully used Supra-renal extract in the first decimal trituration in the treatment of threatening gangrene of the toes in diabetes mellitus,

**Ergotole in Diabetes Insipidus.**—Dr. M. J. Bliem reports "quick results" from use of Ergotole gts x., four times daily for a week, in a case in which the patient was passing 96 ounces of urine and 900 grains of urea.<sup>4</sup>

[Van Deusen, of Philadelphia, gave Scilla 2x dilution, twelve drops daily in six doses, successfully in a case of like nature.]

**Note on Edebohl's Operation.**—Dr. G. F. Suker, of Chicago, has followed up the results of decapsulation of the kidneys with reference to retinitis. He finds that in seventeen cases of double contracted kidney and retinitis death took place within two years after the operation in all the cases. He reasons that when cardio-vascular changes are present the operation is only of temporary benefit.

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710 CLINICAL MEMORANDA AND SUMMARY.

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## INDEX.

- Abnormal Metabolism, 672.  
Abscess of Bladder, 635.  
Abscess of the Kidney, 266.  
Absence of Kidneys, 70.  
ACONITE, 97, 110, 139, 148, 157, 238,  
    244, 274, 443, 444.  
Actinomycosis, 264.  
Active Hyperæmia of the Kidneys,  
    93, 621.  
Acute Alcoholic Nephritis, 133.  
    Dilatation of the Heart, 148.  
    Diffuse Nephritis, 116.  
    Diphtheritic Nephritis, 129.  
    Glomerulo-Nephritis, 116.  
    Interstitial Nephritis, 134.  
Acute Nephritis, 114, 622.  
    from cold, 133.  
    in typhoid fever, 130.  
    in pneumonia, 130.  
Acute Nephritis of Gastro Enteritis,  
    132.  
Acute Nephritis of Pregnancy, 149,  
    623.  
Acute Parenchymatous Nephritis,  
    114.  
Acute Post-Scarlatinal Nephritis,  
    125.  
Acute Prostatitis, 637.  
Acute Uræmia, 77.  
Adrenalin, 701.  
Albuminoid Kidney, 252.  
Albuminuria, 48.  
    cyclical, 49.  
Albuminuria, mortality from, 611.  
    fatal cases, 617.  
Amyloid Kidney, 627.  
Anatomy of the Kidneys, 17.  
Anæmia of the Kidneys, 91.  
Aneurism of the Kidney, 91.  
Anomalies of the Kidney, 53.  
Anomalies of Number of Kidneys, 69.  
Anomalies of Size of Kidneys, 69.  
Anuria, Calculous, 685, 686.  
Anuria from Anæsthetics, 98.  
APIS, 139, 158, 184, 433.  
APOCYNUM CAN., 111, 140, 158, 193,  
    194, 609.  
ARGENTUM NITRICUM, 372.  
Argyrol, 706.  
ARNICA, 98, 110, 274, 433, 444.  
ARSENICUM, 66, 183, 344, 396, 433,  
    577.  
ARSENICUM IODATUM, 258.  
Arterio-sclerotic Kidneys, 247.  
Arterial Tension, 196.  
Aspirin, 708.  
Atrophy of Bladder, 403.  
Atrophy of the Kidneys, 205.  
AURUM MURIATICUM, 97, 238, 258.  
Bacteriuria, 707.  
BAPTISIA, 317, 438.  
BAROSMA, 345.  
Basham's Mixture, 183.  
BELLADONNA, 111, 140, 157, 243, 274,  
    377, 443, 444.  
Benign Tumors, Renal, 287.  
BENZOIC ACID, 345, 433, 438.  
Benzosol, 708.  
BERBERIS, 345, 372, 433.  
Bladder, Diseases of, 404.  
Blood-vessels of the Kidney, 34.  
Bowman's Capsule, 33.  
BRYONIA, 388, 504, 577.  
CALCAREA CARB., 317, 372.  
CALCAREA HYDRIODICA, 317.

- Calculus, Renal, 347.  
**CAMPHORA**, 98, 434.  
 Carcinoma (see Cancer).  
 Cancer of Kidney, 289.  
 Cancer of Prostate, 639.  
**CANNABIS INDICA**, 243, 373, 434.  
**CANNABIS SATIVA**, 434.  
**CANTHARIDES**, 140, 184, 343, 373,  
    434, 439.  
**CAPSICUM**, 434.  
 Capsular Nephrotomy, 198.  
 Capsule of the Kidney, 23.  
 Catheter, Use of, 446.  
 Catheter Fever, 447.  
**CHAMOMILLA**, 377.  
**CHINA**, 317, 377.  
**CHIMAPHILA**, 344, 434, 494.  
 Chronic Cystitis, 421.  
     Degeneration (renal), 262.  
 Chronic Haemorrhagic Nephritis,  
    164, 171, 172.  
 Chronic Indurative Nephritis, 206,  
    624.  
 Chronic Interstitial Nephritis,  
     primary, 206, 625.  
     secondary, 204.  
 Chronic Non-indurative Nephritis,  
    161, 624.  
 Chronic Nephritis, 161.  
     Nephritis and Baths, etc., 679.  
     Nephritis and Pneumonia, 681.  
     Prostatitis, 638.  
     Uræmia, 79.  
 Chyluria, 398.  
**CICUTA VIROSA**, 147.  
**CIMICIFUGA**, 388.  
**CINA**, 527.  
 Climatology, 181.  
 Clinical Features of Renal Diseases,  
    47.  
 Clinical Notes, 671.  
 Cloudy Swelling (renal), 261.  
**COCCE'S CACTI**, 435.  
 Collection of Urine, 665.  
 Columns of Bertini, 25.  
     Complications of Urinary Diseases,  
        651.  
**CONIUM**, 435, 501.  
 Contracting Kidney, 206, 625.  
 Contracting Kidney in Children, 684.  
 Convoluted Tubules, 27.  
**CONVALLARIA**, 110.  
**COPAIBA**, 435.  
 Cortex of the Kidney, 24.  
**CRATEGUS**, 111.  
**CREOSOTUM**, 577.  
**CROTALUS**, 402.  
 Cryoscopy, 77, 667.  
**CUBEBA**, 435.  
**CUPRUM ARSENICUM**, 140, 157, 159.  
 Cylindruria, 612.  
 Cystalgia, 697.  
 Cystinuria, 397.  
 Cystic Kidney, 627.  
 Cystitis, 421.  
     Treatment of, 431, 624.  
 Cystitis,  
     Adrenalin in, 701.  
     in La Grippe, 699.  
     Cooper's Treatment of, 699.  
 Cystitis in Typhoid, 698.  
     Grippe, 699.  
     Treatment of, 699.  
 Cystocele, 404.  
 Cystoplegia, 416.  
 Cystospasmus, 417, 419.  
 Cystoscopy, 696.  
 Cysts of the Kidney, 280.  
     Decapsulation of Kidneys, 709.  
 Degenerations of the Kidney, 261.  
 Delayed Renal Excretion, 73.  
 Development of the Kidney, 17.  
 Diabetic Dietary, 707.  
 Diabetes Insipidus, 601, 640.  
 Diabetes Mellitus, 531.  
     blood, 552.  
     clinical classification, 552.  
     features, 542

- Diabetes**: coma, 586.  
 complications, 554.  
 course, 558.  
 diagnosis, 541.  
 diet, 564.  
 etiology, 531.  
 occurrence, 535.  
 onset, 539.  
 pathology, 536.  
 post-mortem changes, 538.  
 prognosis, 554.  
 termination, 558.  
 treatment, 558.  
     of prodromal stage, 575.
- Diabetes Mellitus** (Clinical Notes).  
 aspirin in, 708.  
 potatoes in, 708.  
 benzosol in, 708.  
 eucalyptus in, 708.  
 ergotole in, 709.  
     supra-renal extract in, 709.
- Diabetes Mellitus**, summary of, 639.
- Diet** in Nephritis, 678.
- DIGITALIS**, 110, 245, 377.
- Dilatation of Bladder, 405.
- Dimensions of the Kidney, 22.
- Diseases of Renal Pelvis, 321.
- Diverticula of Bladder, 404.
- Dropsy** in Acute Nephritis, 123, 147.  
     Renal Hyperæmia, 105.
- DULCAMARA**, 98.
- Dyspnœa**, 195.
- Eclampsia, 151.
- Edebohl's Operation**, 198, 709.  
     Effect on Retinitis, 709.
- Elimination of Urinary Solids, 671.
- Embolus of the Kidney, 90.
- Euuresis, 523.  
     Treatment, 529, 707.
- Epidural Injections, 707.
- Epithelium of the Tubules, 30.
- EQUISETUM**, 435.
- Ergotole, 709.
- ERIGERON**, 435.
- EUCALYPTUS**, 97, 435.  
 Eucalyptus tea, 708.
- Exstrophy of Bladder, 404.
- Fatty Change (renal), 262.
- FERRUM**, 141, 183, 608.
- Fever in Uræmia, 678.
- Fistula of Kidney, 264.
- Floating Kidney, 54.
- Form of the Kidney, 22.
- GELSEMIUM**, 66, 157, 389, 434, 444.
- Glanders, 264.
- Glomerulus, 33.
- GLONOIN**, 97, 148, 158, 239, 243.
- Glycosuria, 530.
- Gross Pathology, Synopsis, Non-suppurative Renal Lesions, 664.
- HAMAMELIS**, 299.
- Headache, 195.
- HEDEOMA**, 389, 699.
- HELEBORUS NIGER**, 141.
- Helmitol, 703.
- HELIONIAS**, 157, 609.
- HEKLA LAVA**, 274.
- Hæmatoporphyrinuria, 402.
- Hæmaturia, 399, 401, 701.
- Hæmoglobinuria, 401, 685.
- HEPAR SULPHUR**, 258, 274.
- High Arterial Tension, 244.
- Horseshoe Kidney, 68.
- Hydatids, Renal, 284.
- Hydragogin, 190.
- HYDRASTIS**, 258.
- Hydronephrosis, 322, 631.
- Hydrothionuria, 402.
- HYOSCYAMUS**, 158, 436, 444.
- Hyperæmia of Renal Pelvis, 321.
- Hyperæmia of Bladder, 420.
- Hypernephromia, 299.
- Hypertrophy of Bladder, 405.
- Hypertrophy of Prostate, 638, 705.  
     Operations for, 705.
- IGNATIA**, 66.

- Indicanuria, 402.  
 Induction of Labor, 677.  
 Inflammations of the Kidney, 112.  
**IODINE**, 249.  
 Irritable Bladder, 405, 409.
- JABORANDI**, 141.
- KALI CHLORICUM**, 185, 402.  
**KALI HYDRIODICUM**, 239, 258.  
**KALI SULPHURICUM**, 394.  
 Kidney of Pregnancy, 675.
- Labyrinth of Ludwig, 20.  
**LACHESIS**, 67, 158.  
**LACTIC ACID**, 577.  
 Lactosuria, 402.  
 Lævulosuria, 403.  
 Lardaceous Kidney, 252.  
 Large Mottled Kidney, 164, 171, 172.  
 Large White Kidney, 161, 624.  
 Leukemia, 264.  
 Leprosy, 263.  
 Lithæmia, 380, 685.  
**LITHIA**, 97, 159, 388.  
 Lithuria, 380.  
 Lipaciduria, 402.  
 Lipuria, 402.  
 Lobulated Kidney, 68.  
 Location of the Kidney, 17.  
**LVCOPODIUM**, 258, 373, 436.  
**LVCOPUS**, 438  
 Lymphatics of the Kidney, 23.
- Malformations of the Bladder, 404.  
 Malformations of Renal Pelvis, 321.  
 Malignant Tumors, Renal, 289, 633.  
 Malpighian Tufts, 33.  
 Markings of the Cortex, 25.  
 Medulla of the Kidney, 25.  
 Melanuria, 402.  
**MERCURIUS BINIODATUS**, 258.  
**MERCURIUS COR.**, 98, 142, 158, 184, 240, 436, 504.  
**MERCURIUS DULCIS**, 141, 240, 243, 250.  
**MERCURIUS SOL.**, 258.
- Metastatic Abscess of Kidney, 266.  
 Methylene-blue Test, 74, 643.  
 Methyloids, 701.  
**MILLEFOLIUM**, 299.  
 Milk Diet, 178.  
 Mineral Baths in Nephritis, 679.  
 Mineral Waters in Nephritis, 679.  
 Misplacements of the Kidney, 53.  
 Motor Neuroses, 417.  
 Movable Kidney, 54, 621.  
 Multilocular Cystic Kidney, 280.  
 Myelopathic Albumosuria, 681.
- Nephritis**—  
 Acute, 114, 136.  
     alcoholic, 133.  
 Acute diffuse, 116.  
     diphtheritic, 129.  
 Acute glomerulo-, 116.  
     interstitial, 134.  
     in cholera, 131.  
     in gastro-enteritis, 132.  
     in pneumonia, 129.  
     in pregnancy, 149.  
     in plague, 131.  
     in typhoid fever, 130.  
     in yellow fever, 131.  
     from exposure, etc., 133.  
     parenchymatous, 174.  
     post-scarlatinal, 125.  
     suppurative, 266.  
 Chronic, 161.  
     arterio-sclerotic, 247.  
     diffuse, 161.  
     haemorrhagic, 164, 171.  
     indurative, 204.  
     interstitial, 204, 206.  
     suppurative, 267.
- Nephrolithiasis, 347.  
 Nerves of the Kidney, 23.  
 Neuralgia of Bladder, 405.  
**NITRIC ACID**, 185, 241, 258, 317, 434.  
 Nitrogenous Metabolism, 672.  
 Normal Salt Solution, 195.  
 Nucleoalbuminuria, 403.

- NUX VOMICA**, 185, 241, 377, 389, 436.  
**Ocular Manifestations of Bright's Disease**, 683.  
**Operations on Prostate**, 705.  
**OPIUM**, 158, 373.  
**Oxaluria**, 390.  
**Pain in Urinary Diseases**, 640.  
**Paralysis of the Bladder**, 416, 418.  
**Paranephric Abscess**, 274, 627.  
**Parasites of Renal Pelvis**, 347.  
**PAREIRA BRAVA**, 573, 436.  
**Paroxysmal Hæmoglobinuria**, 685.  
**Passive Renal Hyperæmia**, 99, 622.  
**Pathology, Table of Gross**, 664.  
**Patient in Renal Diseases**, 51.  
**Patulous Urachus**, 404.  
**Pericarditis**, 168.  
**Paranephric Abscess**, 274.  
**PETROLEUM**, 436.  
**Phloridzin Diabetes**, 76.  
**Phosphaturia**, 394.  
**PHOSPHORIC ACID**, 185, 258, 397, 436, 577.  
**PHOSPHORUS**, 110, 373, 402, 436.  
**Physical Examination of the Kidneys**, 40.  
**Pigmentations, Renal**, 394.  
**PIPER METHYSTICUM**, 436.  
**PLUMBUM**, 241, 437.  
**POLYGONUM**, 437.  
**POPULUS**, 437, 699.  
**Position of Surfaces of the Kidney**, 19.  
**Potatoes in Diabetes**, 708.  
**Prognosis (Clinical Notes)—**  
 Examination of urine in, 658.  
 in acute nephritis, 659.  
 in chronic nephritis, 659, 660.  
 in puerperal nephritis, 661.  
 in kidney of pregnancy, 661.  
 in pneumonia, 662.  
 in diabetes mellitus, 662.  
 in Addison's disease, 662.  
 in typhoid fever, 662.  
**Prevesical Inflammation**, 635.  
**Prostate, Hypertrophied**, 482, 704, 705.  
**Prostatitis**, 501, 505, 507.  
**Prostatic Abscess**, 504, 638.  
 Cancer, 508.  
**PRUNUS SPINOSA**, 437.  
**Puerperal Eclampsia**, 151.  
**Pulmonary Edema**, 149.  
**Purinometer**, 693.  
**Purulent Nephritis**, 266.  
**PULSATILLA**, 66, 504.  
**Pyelitis**, 333, 629.  
**Pyelo-nephritis**, 266.  
**Pyonephrosis**, 330, 632, 685.  
**Pyramids of Ferrein**, 25.  
**Renal—**  
 abscess, 628.  
 calculus, 347, 630, 685.  
 degenerations, 262.  
 hyperæmia, 93, 99, 622.  
 embolism, 621.  
 infarct, 673.  
 inflammations (see nephritis).  
 growths, 280.  
 papilla, 687.  
 permeability, 671.  
 syphilis, 263.  
 tenesmus, 377.  
 tuberculosis, 305, 632.  
 tumors (see growths).  
**Relations of the Kidneys**, 20, 21.  
**Retinitis Albuminurica**, 220, 709.  
**RHUS AROMATICA**, 527, 609.  
**RHUS TOX.**, 142.  
**SABAL SERRULATA**, 438.  
**Sarcoma of Kidney**, 289.  
**Salicylates and Nephritis**, 674.  
**SANTALUM**, 437.  
**SARSAPELLA**, 373, 437.  
**Scarlatinal Nephritis**, 125, 673.  
**SCILLA**, 608.  
**Scurvy in Children**, 401.  
**SECALE**, 501, 609.

- Section of the Kidney, 24.  
**SENEGA**, 437.  
**SEPIA**, 373, 437.  
 Sequences of Urinary Diseases, 650.  
**SILICEA**, 274.  
 Solitary Kidney, 69.  
 Stellated Veins, 35.  
 Stone—  
   in bladder, 635.  
   in kidney, 347.  
   in prostate, 510.  
   in urethra, 513.  
**STIGMATA MAIDIS**, 344, 438, 494.  
 Straight Tubules, 30.  
**STRAMONIUM**, 158.  
 Stroma, Renal, 36.  
**STROPHANTHUS**, 109, 185, 250.  
**STRYCHNIA**, 66, 250, 608.  
**SULPHUR**, 66, 438.  
 Support of the Kidney, 22.  
 Suppression of Urine, 686.  
 Suppurative Nephritis, 266, 629.  
 Supra-Renal Extract, 709.  
 Surgical Kidney, 266.  
 Syphilis of the Kidney, 263.  
**SYZYGIUM JAMBOLANUM**, 580.  
  
 Tapotement for Incontinence, 703.  
**TREBINTHINA**, 97, 142, 158, 186,  
   344, 438.  
 Theocin, 684.  
 Theories of Secretion, 37.  
**THLASPI**, 299, 374.  
 Thrombosis, Renal, 89.  
**THUJA**, 437, 501, 609.  
 Tissues of the Kidney, 26.  
 Topography of the Kidney, 17.  
 Tuberculosis—  
   of bladder, 454, 635, 695.  
   of kidney, 305, 346, 694.  
   of prostate, 507, 638.  
 Tumors of bladder, 464, 636.  
   renal pelvis, 347.  
   prostate, 508.  
 Tunica Adiposa, 23.  
  
 Turpentine Poultices, 684.  
 Trauma of Kidney, 264, 672.  
 Treatment of acute nephritis, 136.  
   of chronic " 173, 231.  
   of dropsy, 187.  
  
 Unsymmetrical Kidney, 69.  
 Uræmia, 71, 197, 644, 646.  
 Uræmic Aphasia, 83.  
 Uræmic Convulsions, 144.  
   Fever, 678.  
 Uræmic Paralysis, 81.  
 Uræmic Ulcers, 87.  
**URANIUM NITRICUM**, 158, 577.  
 Uraturia, 380.  
 Urea—  
   relation to mortality, 615, 619.  
 Ureteral Catheterism, 696.  
 Ureteritis, 377, 633, 687.  
 Uricaciduria, 380.  
 Uric Acid Diathesis, 380, 691.  
   Woods-Hutchinson theory, 692.  
   Sidonal in, 693.  
   Purinometer, 693.  
 Uriniferous Tubules, 27.  
 Urinary Incontinence, 523, 703.  
   iu women, 703.  
   in children, 523, 707.  
 Uriseptiu, 701.  
 Urobilinuria, 403.  
**UROTROPIN**, 396.  
**UVA URSI**, 344, 438.  
  
**VERATRUM ALBUM**, 377.  
**VERATRUM VIRIDE**, 98, 111, 142, 148,  
   159, 274, 444.  
 Vesical Hemorrhoids, 421.  
 Vesical Spasm, 696.  
 Vessels of the Kidney, 22.  
 Vomiting in Nephritis, 148.  
  
 Washing Out the Bladder, 444.  
 Weight of the Kidneys, 22.  
 Waxy Kidney, 252.







